Vol. XVIII, No. 6 JULY, 1947

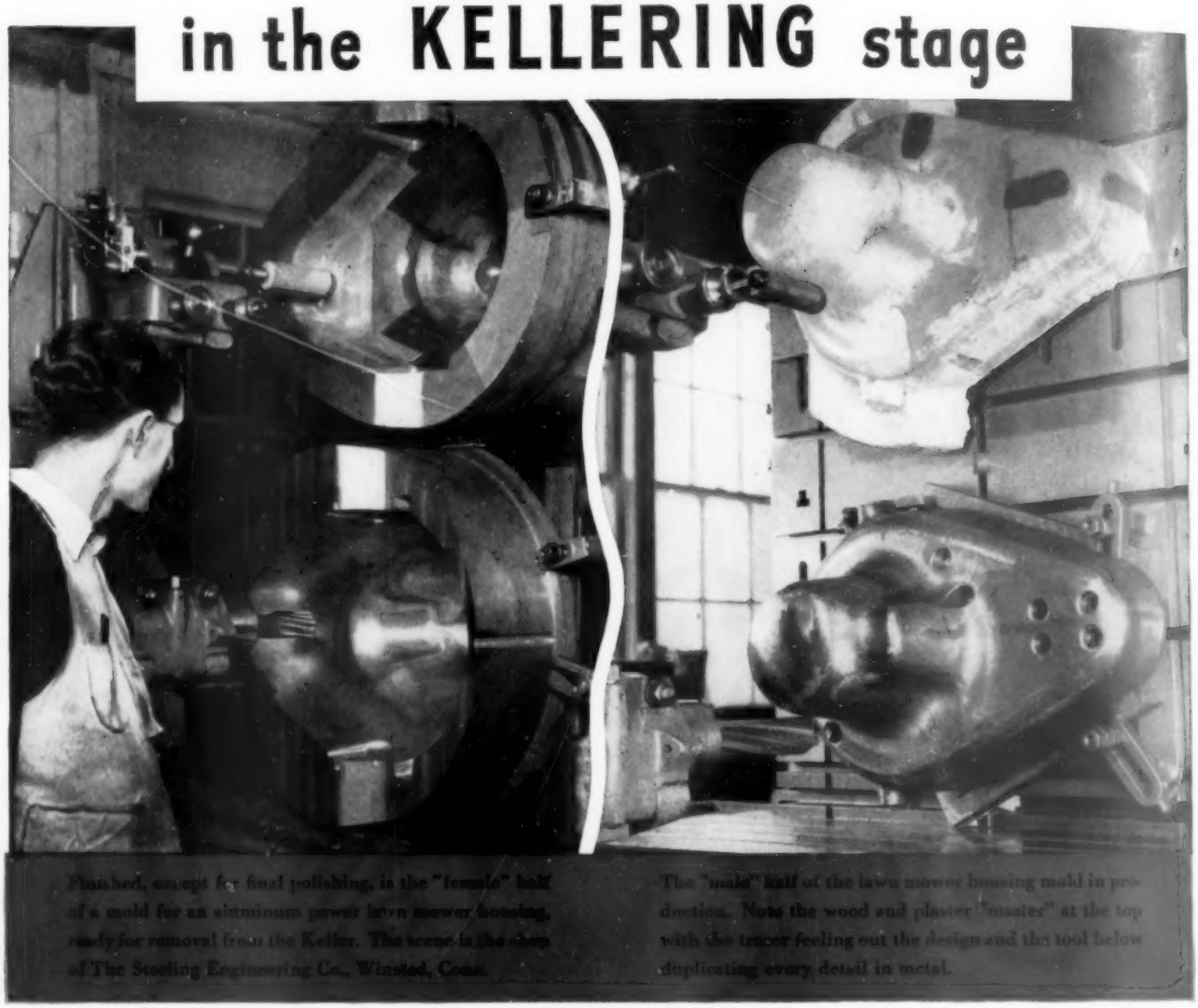
THE TOOL ENGINEER

OFFICIAL PUBLICATION OF THE ASTE AMERICAN SOCIETY OF TOOL ENGINEERS

Departments

Behind every product that is mass produced is the tool engineer

Meet your new POWER lawn mower in the KELLERING stage



Finished, except for final polishing, is the "female" half of a mold for an aluminum power lawn mower housing, ready for removal from the Keller. The scene is the shop of The Sterling Engineering Co., Winsted, Conn.

The "male" half of the lawn mower housing mold in production. Note the wood and plaster "master" at the top with the tracer feeling out the design and the tool below duplicating every detail in metal.

Let the green grass grow — who cares? Your new power lawn mower is on the way. You see it taking form in these pictures as Keller Machines cut the male and female cavities of a large mold for the aluminum lawn mower housing.

Tracer-controlled milling or "Kellering" is the accepted modern method of creating dies and molds. The sensitive electrically controlled tracer feels out the most complicated details in the easily-made wood or plaster "master" and the following cutter duplicates them in tough steel. Fast, faithful and finished is the work of Keller Machines, whether they're big ones making car body dies or little ones making small dies, or parts for pilot models.

"Keller it" and watch mold-making time grow shorter, cost grow smaller, quality improve. Equip your own tool shop or patronize Keller-equipped shops. Write for details.

Pratt & Whitney

Division Niles-Bement-Pond Company

WEST HARTFORD 1, CONNECTICUT

The Tool Engineer

Published monthly by The American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

Editorial and Advertising Offices
3559 W. Lafayette Blvd.
Detroit 26, Michigan

July, 1947
Vol. XVIII No. 5

They Grow Together

EVERY AMERICAN knows that readin', 'ritin', and 'rithmetic were taught to the tune of the hickory stick in our early schools. But is he aware of the less audible, but stronger, more persistent music that set the tempo for teaching in those days and the subsequent educational advances? This is the music made by the humming machines of America's ever-growing industrial power upon which our entire future so largely depends.

American industry and education have advanced hand-in-hand, following parallel paths —each creating a demand for the other, each helping to make possible the other's growth. In nearly all activities of our daily life we just naturally assume that everyone can read. Our industrial civilization has made that ability an essential of every day living and, at the same time, has made possible the growth of an educational system which offers to the bulk of our population, not merely the opportunity of learning to read, but of obtaining high school instruction.

Attributing the reorganization of the public education system to include junior high schools and junior colleges to the demands of the new industrial age, George S. Counts, director of the Division of Foundations of Education, Columbia University, has said:

"The traditional seven-, eight-, or nine-year elementary school with its short school year, irregular attendance, untrained teacher and primitive methods of instruction was entirely adequate to the needs of the simple agrarian society which it served. So remote were secondary schools and colleges from the popular masses at this time that these two institutions could hardly be regarded as belonging to the system of public education. . . . Only with the coming of industrialism did the demand for a closely integrated educational structure make itself felt. So if we should endeavor, in a single sentence, to account for the growth of the high school, we would say that it is the product of a new social order—the resultant of a whole series of forces and conditions which we call industrial civilization."

The effect of the technological advances in communications and transportation upon the spread of education is obvious. Improvements in modes of travel—especially the advent of the automobile—made secondary education geographically accessible to all, even to those living in small, comparatively isolated communities.

Changes in the occupational interests of the people were influential in increasing the demand for education and in revising the curriculum to include subjects applicable to the new jobs. A century ago, in rural America, "book larnin'" stamped an individual as an eccentric and a man of little practical value in that particular society. Today, in all sections of the country, a certain amount of formal education has come to be considered essential to a person's success in every practical field.

As the employment trend in the United States swung away from agricultural pursuits and in the direction of the growing industries, thousands of new jobs were created. And the nature of these occupations was such as to demand experience and knowledge which could best be gained through the systematic procedure of formal education. In 1850 there were four producers of goods for every distributor in this country. By 1920 the two groups were of equal size. The number of types of jobs resulting from the introduction of new industries continued to grow until there are now some 20,000 occupational designations common to business, industry and the professions listed by the United States Employment Service.

Parents, who naturally sought the best for their children, recognized not only the economic advantages, but the shorter hours and less manual labor required by these new jobs, and made every effort to provide an education which would enable these children to prosper in the new industrial era.

The phenomenal rise of the general education level in this country has been one of our greatest achievements. School attendance has doubled in the last 50 years. In 1890 only half of the population between the ages of 5 and 19 attended school; by 1910 the number had increased to two-thirds, and in 1940 was approaching 75 per cent. More than 90 per cent of the children in the 10-11-year-old age group were attending school by 1910 and by 1940 that group included almost 90 per cent of all between the ages of 7 and 15. This is accounted for by the fact that our modern industry does not employ high school age people, also by reason of compulsory education laws and the growing desire for education and the advantages it offers.

At the present time, more than 70 per cent of our adult population have completed eight years of formal schooling. Today the average young adult has received three years of high school training, while two generations ago he would have just finished grade school. Indicative of educational progress during the past generation is the comparison of the typical enlisted man of World Wars I and II. In 1917-18 he had completed seven years of school and only 4.1 per cent were high school graduates. The World War II serviceman had 10 years of education and 23 per cent of the enlisted group had finished high school.

It has been said that the only boundary to future expansion of education in this country is the extent of our industrial growth. If this be true—and the history of parallel development indicates that it is—then we may safely say that there is no limit in sight. The education outlook is toward more and better courses in such specialized fields as tool engineering . . . toward better trained men for industry. Yes, the long range outlook is definitely toward a rosy future!

President 1947-48

Directory of A.S.T.E. Chapter Chairmen

AKRON CHAPTER, NO. 47
Second Thursday *
Herman A. Guy, *Chairman*
R. D. No. 1, Alliance, Ohio

ATLANTA CHAPTER, NO. 61
Third Monday *
Dwight L. Hollowell, *Chairman*
3174 Peachtree Dr., N. E.,
Atlanta 5, Ga.

BALTIMORE CHAPTER, NO. 13
First Wednesday *
Thomas F. Burke, *Chairman*
2802 Kennedy Ave.,
Baltimore 18, Md.

BINGHAMTON CHAPTER, NO. 35
1st Wed. after 1st Mon.*
Roland B. Andrews, *Chairman*
461 Vestal Road, R. D. 2,
Binghamton, N. Y.

BOSTON CHAPTER, NO. 33
Second Thursday *
John Ryneska, *Chairman*
Western Ave. 69-A,
E. Lynn, Mass.

BUFFALO-NIAGARA FRONTIER CHAPTER, NO. 10
Second Wednesday *
Albert Kirchgessner, *Chairman*
127 Columbia Drive,
Williamsville, N. Y.

CEDAR RAPIDS CHAPTER, NO. 71
Third Wednesday *
Robert A. Hruska, *Chairman*
2011 D Ave., N. E.,
Cedar Rapids, Iowa

CENTRAL PENNSYLVANIA CHAPTER, NO. 22
Second Tuesday *
Paul P. Stock, *Chairman*
460 Edgehill Rd., York, Penn.

CHICAGO CHAPTER, NO. 5
First Monday *
Fred J. Schmitt, *Chairman*
2727 So. Troy St.,
Chicago 23, Ill.

CINCINNATI CHAPTER, NO. 21
Second Tuesday *
George R. Squibb, *Chairman*
R.R. No. 1, Box 143-K,
Cincinnati 27, Ohio

CLEVELAND CHAPTER, NO. 3
Second Friday *
Edgar W. Baumgardner, *Chairm'n*
13825 Triskett Road,
Cleveland 11, Ohio

COLUMBUS CHAPTER, NO. 36
Second Wednesday *
Walter E. L. Bock, *Chairman*
323 Southwood Ave.,
Columbus, Ohio

DAYTON CHAPTER, NO. 18
Second Monday *
Edgar J. Seifreat, *Chairman*
P.O. Box 332, Dayton 1, Ohio

DECATUR CHAPTER, NO. 58
Second Monday *
Ray W. Howell, *Chairman*
1476 W. Decatur, Decatur, Ill.

DENVER CHAPTER, NO. 77
First Wednesday*
B. J. Hazewinkel, *Chairman*
2355 Jasmine St.,
Denver 7, Colo.

DETROIT CHAPTER, NO. 1
Second Thursday *
Leslie B. Bellamy, *Chairman*
220 E. Milwaukee Ave.,
Detroit 2, Mich.

ELMIRA CHAPTER, NO. 24
First Monday *
Edward Stachel, *Chairman*
927 Spruce St., Elmira, N. Y.

ERIE CHAPTER, NO. 62
First Tuesday *
Mathew H. Hetzel, *Chairman*
1140 West 31st St., Erie, Pa.

EVANSVILLE CHAPTER, NO. 73
Second Monday *
Frank J. Hausfeld, Jr., *Chairman*
R.R. No. 5, Box 30,
Evansville, Ind.

FAIRFIELD CTY. CHAPTER, NO. 6
First Wednesday *
Arthur R. Hunt, *Chairman*
64 Avon St., Devon 2, Conn.

FLINT CHAPTER, NO. 68
Third Thursday *
Norman F. Snyder, *Chairman*
2006 Mt. Elliott, Flint 4, Mich.

FOND DU LAC CHAPTER, NO. 45
Second Friday *
William E. Rutz, *Chairman*
142 Dott St., Fond du Lac, Wis.

FORT WAYNE CHAPTER, NO. 56
Second Wednesday *
Emil W. Mellin, *Chairman*
914 W. Sherwood Terrace,
Fort Wayne 6, Ind.

FOX RIVER VALLEY, NO. 72
First Tuesday *
Roy G. Frogness, *Chairman*
Box 304, Rt. 3, Aurora, Ill.

GOLDEN GATE CHAPTER, NO. 28
Third Wednesday *
Floyd V. Snodgrass, *Chairman*
2601 Maxwell Ave.,
Oakland 2, Calif.

HAMILTON CHAPTER, NO. 42
Second Friday *
William A. Alexander, *Chairman*
88 Prospect St. S.,
Hamilton, Ont.

HARTFORD CHAPTER, NO. 7
First Monday *
Richard A. Smith, *Chairman*
328 Harvard St.,
Hartford 6, Conn.

HOUSTON CHAPTER, NO. 29
Second Tuesday *
Homer Briggs, *Chairman*
6514 Pinehurst,
Houston 3, Texas

INDIANAPOLIS CHAPTER, NO. 37
First Thursday *
John Horton, *Chairman*
816 N. Audubon Road,
Indianapolis 1, Ind.

KANSAS CITY CHAPTER, NO. 57
First Wednesday *
Leroy E. Campbell, *Chairman*
5912 College Ave.,
Kansas City 4, Mo.

LITTLE RHODY CHAPTER, NO. 53
Third Wednesday *
Wilfred J. Pender, *Chairman*
43 Seba Kent Road,
Pawtucket, R. I.

LOS ANGELES CHAPTER, NO. 27
Second Thursday *
Leslie F. Hawes, *Chairman*
1421 N. Edgemont,
Los Angeles 27, Calif.

LOUISVILLE CHAPTER, NO. 54
Second Tuesday *
John E. Paskey, *Chairman*
2322 Greenwood Ave.,
Louisville 11, Ky.

MADISON CHAPTER, NO. 75
1st Tues. after 1st Mon.*
Fred H. Kessenich, *Chairman*
308 E. Wilson St.,
Madison 3, Wis.

MID-HUDSON CHAPTER, NO. 74
First Wednesday *
John L. Petz, *Chairman*
Pendell Road,
Poughkeepsie, N. Y.

MILWAUKEE CHAPTER, NO. 4
Second Thursday *
Paul E. Butzin, *Chairman*
8104 Richmond Court,
Wauwatosa 13, Wis.

MONTREAL CHAPTER, NO. 50
Second Wednesday *
Henry T. Welch, *Chairman*
732 Victoria Ave.,
St. Lambert, Que.

MUNCIE CHAPTER, NO. 70
Second Wednesday *
Robert L. Waters, *Chairman*
811 March St., Muncie, Ind.

NASHVILLE CHAPTER, NO. 43
Third Friday *
Guy Hamilton, *Chairman*
518 3rd Nat'l Bank Bldg.,
Nashville 3, Tenn.

NEW HAVEN CHAPTER, NO. 41
Second Thursday *
Ray E. Gifford, *Chairman*
96 Kimberly Ave.,
East Haven 12, Conn.

NEW ORLEANS CHAPTER, NO. 60
Second Wednesday *
Carl Hazlewood, *Chairman*
6574 General Haig
New Orleans 19, La.

NEW YORK, GREATER, CHAPTER, NO. 34
First Monday *
Harmon S. Hunt, *Chairman*
325 Cherry St.,
Douglaston Manor, L. I., N. Y.

NIAGARA DISTRICT CHAPTER, NO. 65
Second Friday *
William L. Sandham, *Chairman*
94 Duncop Drive,
St. Catharines, Ont.

NORTH TEXAS CHAPTER, NO. 51
2nd Fri. (Tentative) *
Theodore A. Hersh, *Chairman*
2901 Westridge Ave.,
Ft. Worth 7, Texas

NORTHERN NEW JERSEY CHAPTER, NO. 14
Second Tuesday *
Edward T. Ross, *Chairman*
223 Bellevue Ave.,
Upper Montclair, N. J.

PEORIA CHAPTER, NO. 31
First Tuesday *
R. C. Kolb, *Chairman*
98 N. Maplewood Ave.,
Peoria 5, Ill.

PHILADELPHIA CHAPTER, NO. 15
Third Thursday *
Arthur R. Diamond, *Chairman*
Greene Manor,
Johnson and Greene Sts.,
Philadelphia 44, Pa.

PHOENIX CHAPTER, NO. 67
Third Wednesday *
Harry E. Rives, *Chairman*
Rt. No. 1, Box 43-D,
Tempe, Arizona

PITTSBURGH CHAPTER, NO. 8
First Friday *
Paul H. Magnus, *Chairman*
Tranter Mfg. Co.,
105 Water St.,
Pittsburgh 22, Pa.

PONTIAC CHAPTER, NO. 69
Third Thursday *
Albert J. Rhodes, *Chairman*
1245 Rhodes Rd.,
Lake Orion, Mich.

PORTLAND (MAINE) CHAPTER, NO. 46
Fourth Friday *
Carl L. Bohlin, *Chairman*
28 Hall Ave., Saco, Maine

PORTLAND (OREGON) CHAPTER, NO. 63
Third Thursday *
William E. Brennan, *Chairman*
3036 S.E. 33rd Ave.,
Portland 2, Ore.

POTOMAC CHAPTER, NO. 48
First Thursday *
Richard P. Thayer, *Chairman*
4704 Butterworth Pl., N.W.,
Washington 16, D. C.

RACINE CHAPTER, NO. 2
First Monday *
William P. Clark, *Chairman*
2105 Washington Ave.,
Racine, Wis.

RICHMOND CHAPTER, NO. 66
Second Tuesday *
Lowell B. Penland, *Chairman*
2509 E. Main St.,
Richmond, Ind.

ROCHESTER CHAPTER, NO. 16
First Monday *
Milton L. Roessel, *Chairman*
97 Biltmore Drive,
Rochester 12, N. Y.

ROCKFORD CHAPTER, NO. 12
First Thursday *
Earnest Y. Seborg, *Chairman*
1523 Huffman Blvd.,
Rockford, Ill.

ST. LOUIS CHAPTER, NO. 17
First Thursday *
Edward H. Ruder, *Chairman*
57 Hanley Downs,
Richmond Heights 17, Mo.

SAN DIEGO CHAPTER, NO. 44
Second Tuesday *
Raymond W. Peters, *Chairman*
2442 Comstock Drive
San Diego 11, Calif.

SCHENECTADY CHAPTER, NO. 20
Second Thursday *
John Stedman, *Chairman*
54 Broderick St.,
Albany 5, N. Y.

SEATTLE CHAPTER, NO. 39
Second Tuesday *
Gordon Munro, *Chairman*
Rt. 4, Box 2432
Bremerton, Wash.

SOUTH BEND CHAPTER, NO. 30
Second Tuesday *
Edgar W. Helm, *Chairman*
1152 E. Victoria St.,
South Bend 14, Ind.

SPRINGFIELD (ILLINOIS) CHAPTER, NO. 64
First Tuesday *
Henry G. Becker, *Chairman*
830 No. 5th St.,
Springfield, Ill.

SPRINGFIELD (MASS.) CHAPTER, NO. 32
Second Monday *
Alexander W. Todd, *Chairman*
50 Johnson St.,
Springfield 8, Mass.

SPRINGFIELD (OHIO) CHAPTER, NO. 76
First Monday*
James B. Douglas, *Chairman*
609 E. McCreight,
Springfield, Ohio

SYRACUSE CHAPTER, NO. 19
1st Thurs. after 2nd Mon.*
Hugo C. Klix, *Chairman*
425 Glenwood Ave.,
Syracuse 7, N. Y.

TOLEDO CHAPTER, NO. 9
Second Wednesday *
Albert Hage, *Chairman*
3700 Roanoke Rd.,
Toledo 12, Ohio

TORONTO CHAPTER, NO. 26
Second Monday *
L. M. Jardine, *Chairman*
6 Pepler Ave., Toronto, Ont.

TRI CITIES CHAPTER, NO. 23
Third Monday *
Lennart N. Dahlen, *Chairman*
901 43rd St.
Rock Island, Ill.

TWIN CITIES CHAPTER, NO. 11
First Wednesday *
Clifford V. Lofdahl, *Chairman*
5933 Elliott Ave. S.,
Minneapolis 7, Minn.

TWIN STATES CHAPTER, NO. 40
Second Wednesday *
Alan E. Stubbs, *Chairman*
Highland Rd., Springfield, Vt.

WESTERN MICHIGAN CHAPTER, NO. 38
Second Monday *
Peter C. Maghielse, *Chairman*
2434 Miller Ave., N. W.,
Grand Rapids 4, Mich.

WICHITA CHAPTER, NO. 52
Second Wednesday *
Harold J. Bales, *Chairman*
1702 N. Lorraine Ave.,
Wichita 6, Kan.

WILLIAMSPORT CHAPTER, NO. 49
Second Monday *
Lewis H. Bardo, *Chairman*
2347 Hillside Ave.,
Williamsport, Penn.

WINDSOR CHAPTER, NO. 55
Second Monday *
R. T. Richards, *Chairman*
R.R. No. 1, Windsor, Ont.

WORCESTER CHAPTER, NO. 25
First Tuesday *
Charles W. Monigle, *Chairman*
364 Greenwood St., R.F.D. 2
Millbury, Mass.

* CHAPTER MEETING NIGHT

The Tool Engineer is published monthly at 315 North Grand Avenue, Lansing 1, Michigan in the interest of the members of the American Society of Tool Engineers. Advertising and Editorial departments are located at 550 West Lafayette Boulevard, Detroit 26, Michigan. Subscription is $2.00 per year. Non-members $6.00 per year in the U. S. A., Canada $6.50 per year; all other foreign countries, $8.00 per year. Entered as second-class matter February 8, 1945, at the post office at Detroit, Michigan under the Act of March, 1879.

Hanna Valves

. . . put precise control of mighty muscles at your finger tips

Hanna Unitite Valves are designed and built to give long, trouble-free service. They are quick-acting, packless and permanently tight. Except for periodic lubrication they require no maintenance. They may be used as 3-way or 4-way valves operating at air, oil or water pressures up to 250 psi. for the ⅜", ½" and ¾" sizes; up to 150 psi. for the 1" size and up to 100 psi. for the 1¼" size. They are available in three different styles for standard mounting, column mounting or manifold mounting.

Foot-Operated Valves

● Hanna Foot Operated Valves are available in single and double pedal models for use at pressures up to 250 psi., air or oil.

Speed Control Valves

● Hanna Speed Control Valves provide adjustable control of inflow as well as outflow of air and oil independently to and from one side of cylinder piston. Available in a variety of sizes.

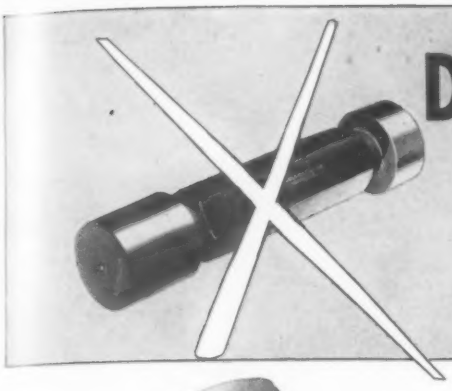
Valve Bulletin

● Bulletin No. 235 gives operating and mechanical data on all Hanna Valves. Write for a copy.

Hanna Engineering Works

HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS

1765 Elston Avenue, Chicago 22, Illinois



DuBo Gages are going over!

Orders and re-orders demonstrate DuBo superiority over cylindrical plug gages

DuBo* Plug Gage

checks bores FASTER, more accurately!

SINGLE END
Sizes 1.510" to 6.010"
(38 mm. to 152 mm.)

DOUBLE END
Sizes .240" to 1.510"
(6 mm. to 38 mm.)

Enthusiastic users all over the country are rapidly replacing cylindrical plug gages with DuBo Gages. The first use unmistakably demonstrates DuBo superiority — its extreme lightness, its ability to detect dimensional deviations (taper and out-of-roundness), its ease, speed and accuracy. STANDARD representatives in leading industrial centers will gladly arrange a demonstration for YOU.

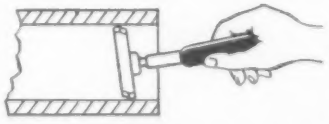
WRITE FOR BULLETIN

*Patents Pending

LIGHT IN WEIGHT

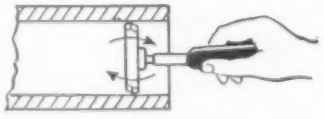
DuBo Gages weigh 70% to 80% less than cylindrical plug gages of equivalent size. Lighter weight means less fatigue, greater accuracy.

EASY TO ENTER



DuBo is entered easily by tipping handle slightly above bore axis (no jockeying necessary). Enters even under-sized bores easily.

DEFINITE CHECK



Enter gage, rock handle gently, bringing spherical gaging surface in contact with bore wall. Whether or not handle drops freely below center is definite yes-or-no answer.

STANDARD GAGE CO., Inc., Poughkeepsie, N.Y.

a Significant *Announcement...*

2 NEW

MURCHEY

TIME AND MONEY SAVING TANGENT CHASER DIE HEADS

Chasers and chaser holding blocks quickly replaced *without losing size adjustment*

The NEW MURCHEY "TRB" Rotating or the "TLB" Stationary Die Head, with extra chasers and blocks preset to exact location in the Murchey fixture, *takes the place of two or more complete tools.*

Down time is reduced to a minimum—replacement of chasers and holding blocks is usually made *without removing tool from the machine.*

Chasers of a given pitch may be used to cut any diameter thread within capacity of the head.

No special equipment is required for close-to-the shoulder threading.

Longer chaser life is assured. Chasers are merely cleaned up on cutting edge—do not have to be ground to a predetermined point when sharpened.

A joint statement
by *SHEFFIELD* and *MURCHEY:*

Present and prospective users of Murchey products are assured of

CONTINUED
product and sales service of the Murchey line of products

AVAILABILITY
of Murchey replacement parts

PROMPT SHIPMENT
of Murchey tools and chasers

FURTHER DEVELOPMENT
of Murchey products through research.

Contact your nearest MURCHEY REPRESENTATIVE on your current threading problems and ask for copy of new MURCHEY catalog—or write direct

MURCHEY MACHINE & TOOL CO.
Detroit 26, Mich.

MURCHEY

DIVISION OF THE SHEFFIELD CORP.
DAYTON 1, OHIO, U.S.A.

2698


MORSE
Spring Tempered Shank has high tensile strength to absorb torsional stress and shock.
Super High Speed Steel Head is butt-welded on shank, for greatest cutting action.
Note Expansion Feature which allows compensation for wear—giving long life to cutting head. Hollow head adjusting screw is countersunk to permit grinding upon centers.

Everything's under Control

Farquhar
HYDRAULIC PRESSES
Increase Hourly Output

With Farquhar Hydraulic Presses, positive control of speed and pressure on the die means greater hourly production. Control of speed and pressure . . .

Eliminates wrinkling and tearing resulting from sharp die impact.

Improves quality of work and does away with unnecessary scrap.

Increases die life and decreases "down-time."

For more complete information on Farquhar Hydraulic Presses, write today.

HYDRAULIC PRODUCTION PRESSES
MATERIAL HANDLING CONVEYORS SPECIAL MACHINERY

Farquhar
HYDRAULIC ... FARQUHAR COMPANY

REPORT № 3

. . . ON TANTUNG* (PERFORMANCE)

BRANCH OFFICE CORRESPONDENCE

TO

FROM

PRODUCT: Tantung
DEPARTMENT: Advertising
COPIES TO: Research
Engineering Sales

DATE: 1947
BRANCH OFFICE: Phila., Pa.
FILE: Milling Cutter Blades
REFERENCE: Upon request

Here's a little story about Tantung I think you will like!

Manufacturers of a nationally known PRESS were milling close grained cast iron pedestals on an old milling machine using 18" cutters. Specifications called for two sides to be parallel and square, shoulders held at 90° to the sides and all machined surfaces to have a fine finish.

The difficult part of the job was—the machine spindle didn't run "true", and the shape of the pedestal, was such, that the cutter had to extend 18" from the spindle face. In using high speed steel cutter blades at slow speeds, runout in the spindle bearing made it impossible to obtain the true 90° surface required. This resulted in taking the piece off the milling machine and finishing the operation on a planer —a minimum of five hours of additional work.

The age of the machine and the slow speeds prohibited the economical use of carbide therefore TANTUNG was suggested AND IT DID THE JOB RIGHT!

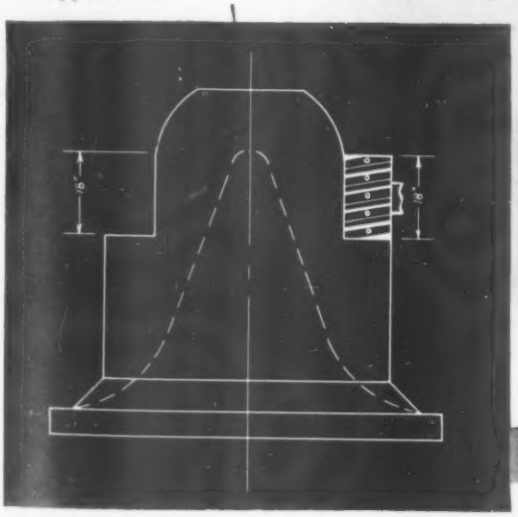
The increased speed possible with Tantung cutter blades, was sufficient to eliminate the runout of the spindle bearing, sides were held absolutely parallel, shoulders held at a perfect 90° angle and the finish was excellent.

In addition to abolishing the planer operation, greatly increased production resulted because TANTUNG cutter blades ran a full shift without regrinding.

P.S. I went away feeling proud of Tantung.

EH: eh

Just one of the 3 MILLION Tantung tool applications.



For additional information on Tantung tools and their applications write your nearest Vascoloy-Ramet Field Engineering Office or direct inquiries to the main Office.

MAKERS OF WORLD'S FINEST VR Carbides

*Reg. U. S. Pat. Off.

VASCOLOY-RAMET CORPORATION NORTH CHICAGO ILLINOIS
District Sales and Service in Principal Cities
An affiliate of The Fansteel Metallurgical Corporation and The Vanadium Alloys Steel Company

5 MILLION ROD BEARINGS

formed with CARBOLO
Sheet Metal Blankin
and Forming Die

...WITHOUT REFINISHING

...AND STILL GOING STRON

Saved cost of 7 Steel Cut-Out Dies, plus 44 maintenance hours, reports Thompson Products Company, Detroit

. . . and still practically as good as new", added Thompson Products Company. After forming 5,000,000 rod bearings with Carboloy Sheet Metal Dies, the record showed that to produce the same number of pieces, 7 steel cut-out dies would have been necessary. This saving also eliminated 44 hours in die maintenance time, resulting in 315,000 *additional* pieces produced.

Now consider these other Carboloy Cemented Carbide benefits: Closer tolerance on drawn parts —fewer" rejects"—lower cost per piece—virtually mirror-smooth finish, often with reductions in buffing time—and sizeable increases in output-per-press. You get more money, more production and less costs with CARBOLOY Sheet Metal Dies.

Carboloy Company Inc.,11108 E. Eight Mile Road, Detroit 32, Michigan.

START THE BALL ROLLING TODAY—WRITE FOR BOOKLET D-120

CARBOLOY® CEMENTED CARBIDE

SHEET METAL DRAWING AND BLANKING DIES

FULLY AUTOMATIZED

Steinle Centerless

THREAD GENERATORS

Small Diameters
LARGE DIAMETERS
JUST CHANGE THE ROLLS

Hollow Parts
Solid Parts
Irregular Parts

•

R—Threading
O—Forming
L—Serrating
L—Burnishing

•

Soft Metals
Pre Heat-Treated Stock
Stainless, Monel

•

A.N. Threads
A.N.P.T. (Pipe) Threads
Acme Threads
Worm Threads
Metric Threads
Whitworth Threads

For Those Long-Run Precision THREAD ROLLING Jobs •

For the past several years Steinle Automatic Centerless Thread Generators have been in successful operation . . . rolling precision threads (class 4 or better) on parts which lend themselves to hopper or magazine loading.

• JUST PRESS THE BUTTON—THE CYCLE IS AUTOMATIC and CONTINUOUS •
Parts are inserted, rolled, and ejected automatically, with no sacrifice to precision.

• RESULTS—MASS PRECISION PRODUCTION OF STRONGER PARTS •

Demonstration at your convenience

THE Steinle MACHINE COMPANY

HARTFORD, CONNECTICUT

Jigs and Fixtures for Resistance Welding Machines

Good Tooling Increases Production, Cuts Costs and Improves the Product

By Howard C. Cogan

TO DESIGN AND BUILD jigs and fixtures for resistance welding machines, one should have considerable data on the physical size and type of each machine. We know, for example, that the "swing" of a lathe, the "spindle diameter" of a drilling or boring machine and the "stroke" of a shaper all help in determining the design of any fixture used with these more familiar machine tools. Resistance welding is likewise divided and subdivided into various types and capacities of machines and operations.

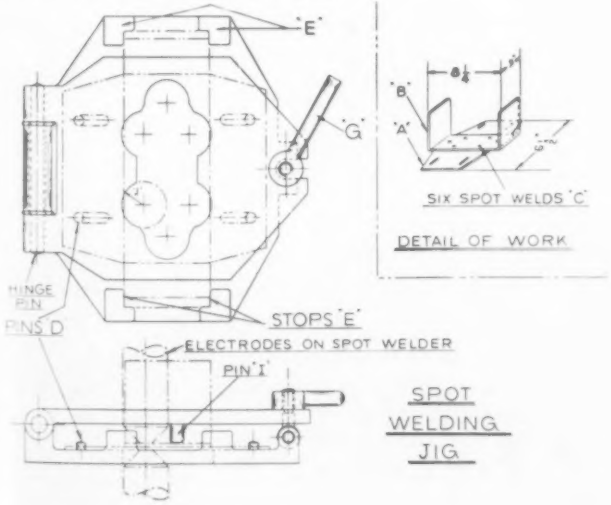
The types of resistance welds are well defined, and machine sizes and capacities have recently been standardized so that interchangeable fixtures are possible. Therefore, the application of jigs and fixtures to standard types of machines can be worked out with conventional designs in a great many cases.

Howard C. Cogan **is Vice-President and Director of Engineering, National Welding Machines Co., Bay City, Mich. A graduate of University of Wisconsin, he was previously Ch'f Engineer with Bendix Brake Company, Welding Div'n, and Ch'f Draftsman with Thompson-Gibb and Gibb Welding Machines Company, Bay City plant.**

For the immediate purpose of this discussion, it will be assumed that the "type of weld," the "machine to be used," and the proposed fixture requirements have already been determined by the welding engineer, or already specified by some authority, and it is the tool engineer's job to design the "fixture" and to supervise its construction and mounting on the machine. To that extent, he is responsible for its satisfactory operation.

In many plants, the tool engineering for resistance welding is done by an entirely separate division of the department, largely because the tool engineer may be unfamiliar with the requirements of such work. This, however, should not be necessary, because the design of jigs and fixtures for resistance welding equipment follows the same fundamental requirements that apply to any high production machine, the object being *increased production*, a more *uniform product* and *reduced* cost of manufacture.

FIG. 1. Details of simple spot welding jig.

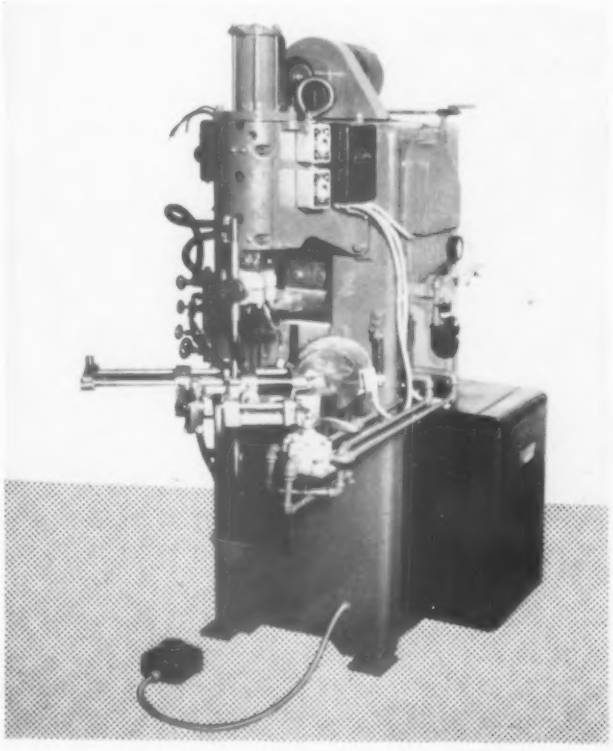


Whenever practicable, copper or other non-magnetic and current-conducting alloys are recommended in place of iron or steel. Provision needs to be made for operator's protection because we are dealing with electrical equipment, and also because, in all welding operations, some splatter or flash is thrown. This, however, is very much reduced in spot and seam welding.

Machine size is determined by its *electrical KVA rating* and its *mechanical pressure capacity*. These fundamentals, with their various subdivisions, can easily become familiar to any tool engineer, and he needs only to apply his usual ingenuity to complete the job of designing jigs and fixtures.

The standard resistance welder is merely a combined electrical and mechanical machine tool—electric power to heat the work at the desired weld location, and mechanical power to press or forge the heated or plastic material into a homogeneous whole. Machines in every type range from 5 to 600 KVA as standard equipment. In terms of horsepower, the range is approximately from 3 to 500.

FIG. 2. Spot welder equipped with supporting and indexing fixture for spot welding jig of the type shown in Fig. 1.



This range of size, and the many different types of mechanical details that are used for pressure application, sometimes confuse engineers when they are confronted with resistance welding applications. It is hard to conceive that, for the welding of two wires a few thousandths in diameter, and the welding of a railroad rail, the same basic fundamentals are used and that, further, the same basic fixture (except for size) is used.

The importance of selecting proper materials for fixtures has been mentioned. The fixture base, clamps, spacers and main parts should be copper, cast or rolled stock or, where heavy pressures are used, any of the various available harder copper alloys. The physical characteristics of these alloys can be readily obtained. For blanking, forming or shearing dies, it is common practice to place hardened steel inserts where the work is done; so, in resistance welding tools, a hard alloy copper face or insert is used, held and supported by the fixture base, to take the load of welding heat and pressure and to be replaced when worn.

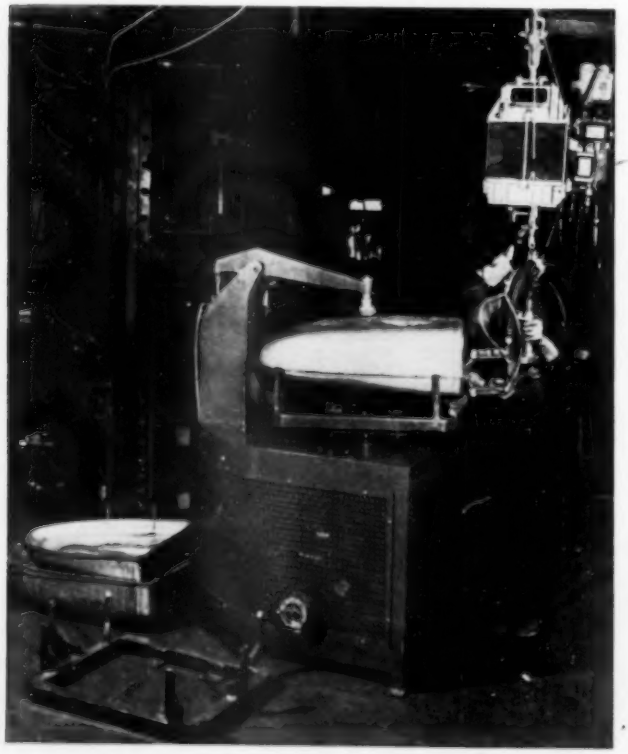
Insulation Necessary

It is necessary to become familiar with the various insulating materials since, as a part of the fixture base, certain locators, index pins, or stops will be used, and these must be insulated from the work to prevent any *shunting current* from by-passing the point of weld and arcing at the stops and locators. This does not mean that a piece of insulation must touch the work, but that somewhere in the fixture the locators are insulated so that a metallic path for the welding current from the upper to the lower machine arms or conductors is not presented.

Size of the fixture base is determined by the work, as in any fixture, but in addition the base must have sufficient cross section to transmit the welding current from the machine platens to the work, and especially so when no other electrodes are used except those incorporated in the fixture. Add some water cooling to both upper and lower fixture assemblies, and the job is done.

Just as there are cutting speed limitations, feeding and traverse speed charts, pressure and load values, and rules and regulations in any fixture design, so also there are general

FIG. 3. Holding and locating fixture for spot welding with portable gun.



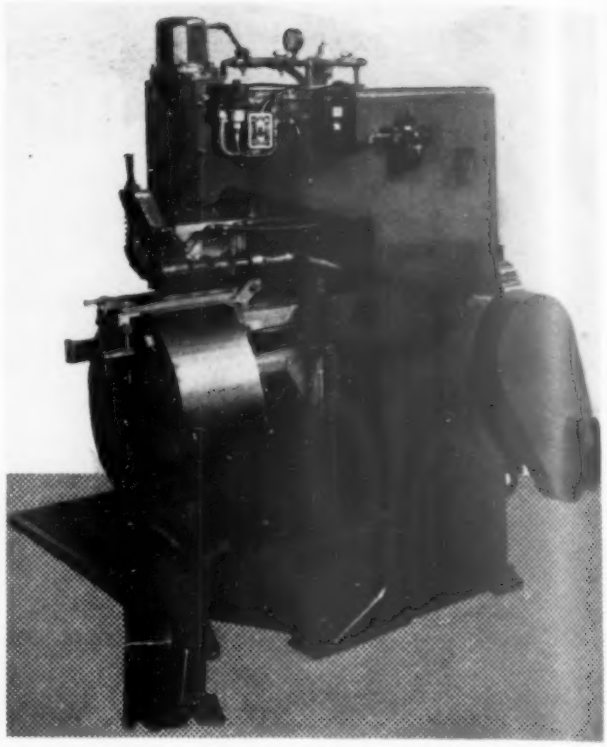


FIG. 4. Fixture for holding and locating edges of round container for welding straight seam.

rules for the design of resistance welding fixtures. A few of the important rules should be mentioned here.

All iron or steel must be kept out of what is called the "Secondary Loop" of a machine. This is the area which, looking at the side of a welder, is surrounded by the upper and lower arms, electrodes and machine base, and approximately 6" each side of the center facing the machine. This area is a highly inductive field, and will heat up magnetic materials and choke back the welding current. Further, at all times keep this area as small as possible. The larger it is, the less efficient the machine.

All auxiliary clamping or locating devices must be insulated, and allowance made for electrode or die wear and for easy replacement of electrodes or dies. Provide flash protection and sufficient water cooling and, most important, remember that since two or more separate pieces are to be loaded—which, when welded, make one assembly—full unloading clearances must be provided.

Failure to provide this unloading clearance is a very common fault. It happens quite frequently and is a continuous source of joy to the shop and embarrassment to the tool engineer. When welding dirty or scaly stock, there is a tendency for the work to stick to the electrodes or dies. Quick unloading, and even the operator's safety, is dependent on the provisions made for suitable stripping or unloading of work.

Last, but not least, provide plenty of water cooling. All resistance welders have a cooling water circuit, and it is a simple matter to break into this circuit, using existing connections. Water should be circulated as close to the point of weld as is practical. Alloy coppers are quite expensive and they have an annealing temperature of about 600°, therefore, any temperature above this nullifies all hardness advantages of the alloy.

Although each individual job requires its own fixtures, and no two men will build the same fixture for a given job, all fixtures are fundamental in some respects. A few of the commonly used types will be described briefly.

The most simple fixtures are those used with standard spot welders. In almost all cases these are work holding jigs,

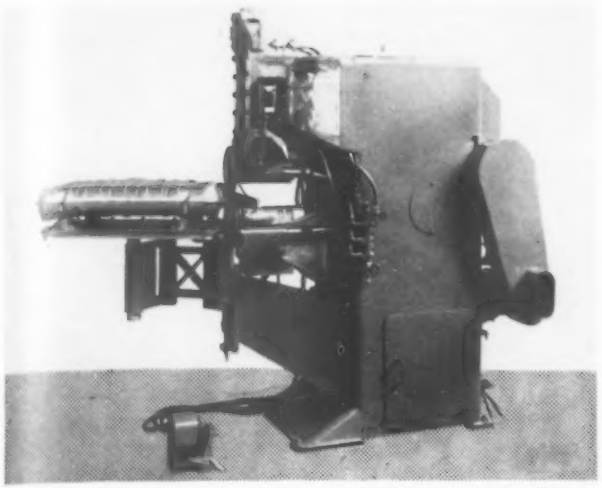


FIG. 5. Ball bearing mounted fixture for welding circumferential tank seam.

usually portable, and spot welds are made at pre-determined spacings. Fig. 1 shows a typical example. Six spot welds are to be placed on this work, and the jig holds and locates the two pieces. Clearances in the top and bottom plate enable the electrodes to locate each spot.

The parts are located by stop pins and blocks as shown, and the hinged top plate locked in position clamps and holds both pieces while they are being welded. In applications which require some welds to be located at corners covered by the jig, it is good practice to make two or three spots, then remove the jig and complete the welds.

Fig. 2 shows an automatic sliding arrangement for a fixture similar to Fig. 1, but supported and automatically indexed for weld locations by a ratchet and pawl actuated by the "up stroke" of the upper electrode, and two cams developed to operate a compound slide. Complete irregular contours or spot spacings can be welded in this manner in one automatic operating cycle.

Among the standard spot welders, the so-called portable spot welding gun must be included, because when they are used the fixture or jig usually plays a most important part. Portable guns are used for work too large to handle or when the locating fixture and the work makes an awkward combination to lift, move or hold for welding in a stationary machine.

Fig. 3 shows the spot tack welding of a fuel tank made in two halves, with a center outside flange. The irregular contour and size would make it complicated and expensive to build a fixture for welding this job on a stationary machine. The fixture shown is readily adaptable to a range of shapes and sizes, and even to other types of assemblies. In the case of more complicated assemblies, such as truck cab bodies, as many as 10 to 20 sections or subassemblies may be held in a single fixture.

The work itself is the basic foundation, and clamping straps, bar locators, hinged retainers and like devices hold and locate each part for spot welding with one or several welding guns. Seam welding fixtures are divided into two main groups, because standard seam welding equipment is so divided. The straight seam welder is used for side or straight seams, as on a container or barrel, and the circular seam welder, for ends, heads or baffles in drums and containers.

A fixture for holding and locating the edges of a round container for the side or straight seam is illustrated in Fig. 4. The fixture is mounted on rollers and, as the welding wheels are driven, the work and fixture is fed into the machine throat during the welding operation, moved out by hand and unloaded.

A circular seam welder with a work holding fixture for another type of fuel tank is illustrated in Fig. 5. This tank has previously been tack or spot welded to hold the two halves together while seam welding. The entire fixture is ball bearing mounted, using a pantagraph arm arrangement with a retaining roller guide. It supports the work and allows it to be automatically fed by the driven welding wheels, while the weld is made entirely around the flanges. Allowance for welding wheel or electrode wear is provided by a vertical adjustment of the entire fixture. These welding wheels are originally 10 inches in diameter, and they wear down to approximately 5 inches.

Accessory Machines Recommended

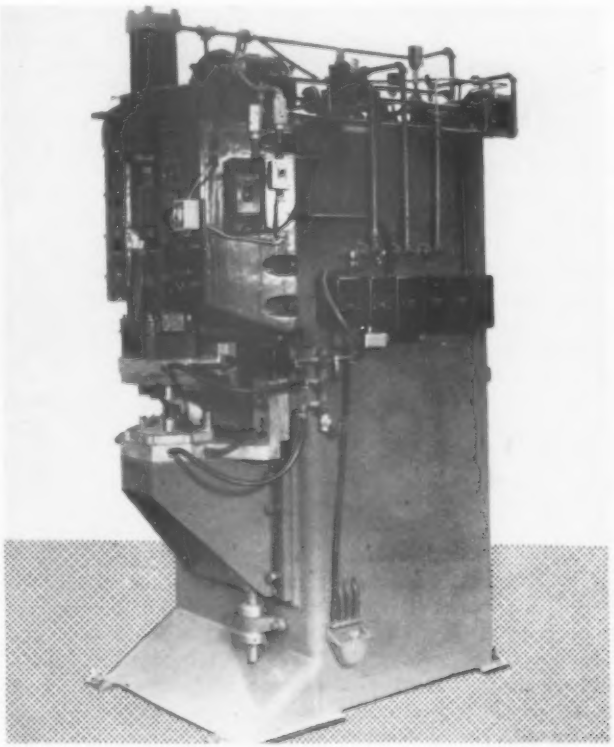
It is good practice on all seam welding jobs to determine whether the work can be spot tack welded prior to seam welding. In a majority of cases it is more economical to purchase a small standard spot welder and, by a very simple jig or fixture, to tack weld the parts and then take the work to the seam welder unhampered by any fixture.

Usually, the clearances required for seam welding operations are far greater than for spot welding and, further, the increased heat required for seam welding and the clamping of the work against the tendency for the lap to spread are quite serious problems due to the limited space between the welding wheels, their bearings and arm extensions. Spot tack welding, as illustrated in Fig. 3, eliminates expensive and complicated fixtures.

For projection welding, individual fixtures and dies are needed for most jobs, because, like a press, the projection welder is of no use until a die or fixture is mounted between the machine platens. Fig. 6 illustrates a relatively simple setup for a projection welding operation. The fixture may take the form of a simple upper and lower die assembly, with locating stops or pins forming a part of the lower assembly. The similarity to punching and forming dies is apparent. Note the short vertical height of this die assembly. This height should always be an absolute minimum for good welding fixture design.

The work may consist of a plate or disc to which several spacers, brackets or stampings are to be projection welded,

FIG. 6. Press type welder equipped with dies for projection welding.



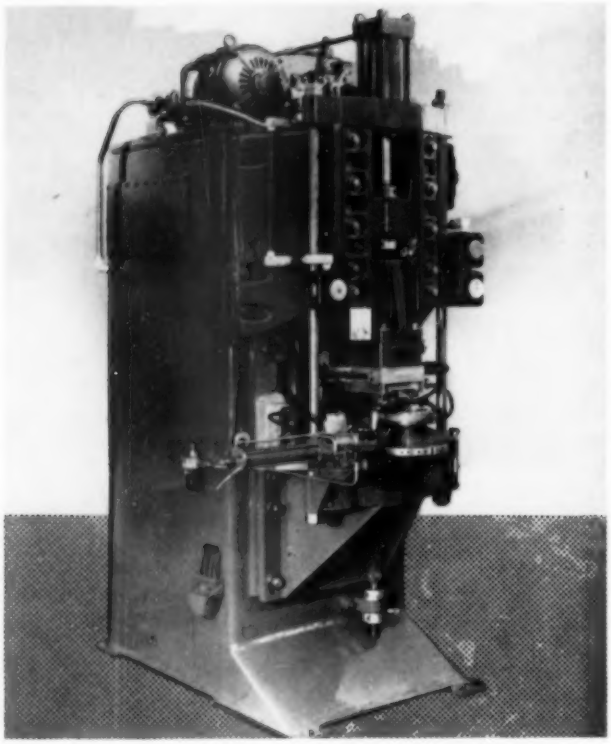


FIG. 7. Indexing fixture for use with projection welding.

making up the assembly. By providing a fixture as shown in Fig. 7, these small parts can be loaded, either all at one time or progressively, and automatically indexing the plate for each part to be welded. This saves considerable handling time. An indexing device such as this can be mounted on either the upper or lower die assembly and can rotate or shift in either direction automatically, with each up stroke of the head.

On heavy projection welding jobs the one piece of work may be large, extending beyond the machine a considerable distance. Extended supports and locators can easily be made but, most important, the smaller parts need to be located and held for welding. Building locators for these parts around the work and supported from the lower platen is difficult and prevents fast loading or unloading. In such cases the smaller parts can be located and held in the upper die or fixture assembly by means of an air operated retainer. The solenoid valve for these cylinders is operated from the machine operating control, and these retainers are released just as the weld is completed and before the head raises.

For smaller parts, spring retainers, a magnet, or air vacuum work holders can be used. These have the advantage of allowing the work to be stripped off automatically, when welded, and do not require a sequence control for releasing after welding. Sometimes the part is allowed to raise with the head and only release when unloading.

Flash or butt welding dies can be the most simple items that are classified as welding fixtures. Because, standard machines being furnished with complete hand, air or hydraulically operated work clamping assemblies, so that it is only necessary to make the dies fit the clamps for mounting and fit the contour of the work for welding. Fig. 8 is a standard type flash welder with simple dies.

These dies must have sufficient area to hold the work for the upset pressure requirements and for conducting the welding current to the work without heating excessively. The lower dies are usually the current carrying members, and therefore are made of current carrying material and water cooled. The upper dies are frequently made of hardened steel, adjustable for alignment and wear.

When standard clamping assemblies cannot be used, flash and butt welding fixtures can also become quite complicated. The special machine shown in Fig. 9 is equipped with an automatic loading, locating, welding and ejecting fixture mounted on a motor driven machine and fully automatic in operation, the work being two straight rods butt welded end to end. The work pieces are loaded in magazines and one operator handles several machines.

There may be times when, because of the necessity of getting started, or because of a comparative short run of production, new equipment is not available, and a request is made to put the job on any existing machine that happens to be handy. In such cases spot welders can be arranged to do simple butt welding jobs by providing work clamping fixtures on the upper and lower arms in place of the spot welding electrodes. Similarly, by placing overlapping spots on a piece of work, a pressure-tight or water-tight seam can be welded on a standard spot welder. Spot or projection welding can easily be done on the same machine, simply by changing the electrodes or dies.

An outboard welding wheel and arm extension on a straight seam welder will enable it to weld both straight and circular seams—or special lower arms and wheel assemblies can be made to suit any practical diameter or length of work. The only requirements are a sufficiently large welding wheel to turn and allow for wear, and for the arm to be within limits of allowable deflection.

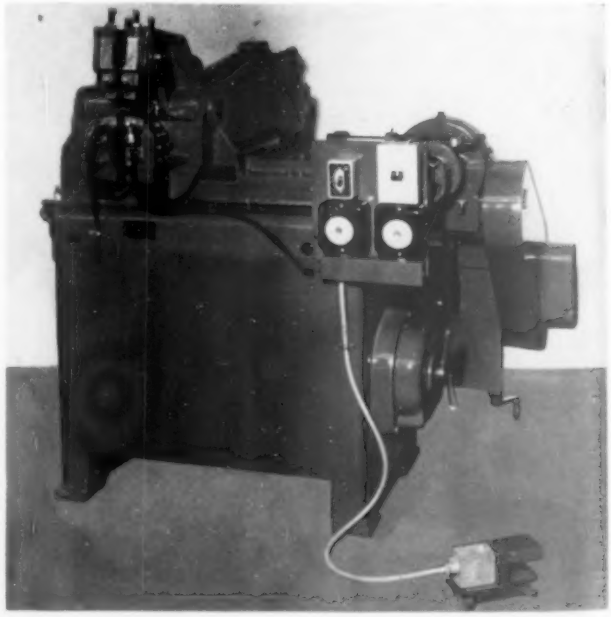
Versatile Performance

Flash and butt welding differ only in the method of machine operation in the case of manual or hydraulic operated machines. On motor operated machines the flashing and upset cam can only be used for flash welding, but suitable compression springs or an air cylinder under static pressure can be inserted between the cam roller and moving platen to do butt welding jobs on a flash welder.

Any resistance welder can also do many brazing jobs, heating and upset jobs; even forming upsets to predetermined diameters or contours. Hot riveting jobs are common on spot and projection welders, and some special fixtures automatically load various gases in welded floats or bulbs, and weld the two halves, all in a single operating cycle.

On many resistance welding jobs increased production can be obtained by having two or more machines operating on the same piece of work. For example, the four corners of a large frame can all be welded simultaneously by four

FIG. 8. Typical standard flash welder equipped with conventional dies.



welders, one at each corner, with one loading and unloading operation.

Fig. 10 shows two projection welders mounted on a sub-base with a work support and locating fixture forming a horizontal tie between the machines for welding two end brackets to an axle stamping. The machines can be controlled by a single starting button—as for a single welding machine—and even alternate firing of the welding current can be provided, during the operating cycle, if necessary to reduce power loads.

Two seam welders can also be used face to face, with a work holding conveyor between them. The conveyor can be continuously or intermittently driven and two seam welds placed on a container or tank, and the work immediately passed through a second setup; thus all four sides can be completed. Usually the work welded in this manner consists of two half stampings with a welded outside flange at the center—the welds crossing one another at the corner to complete a pressure-tight seam.

Automatic dial feeds are commonly used for all kinds of press operations—drilling, tapping and milling. They can also be used for resistance welding operations, as in Fig. 11. Mechanically, they may employ any conventional means of intermittent motion. It is necessary to keep this drive out of the secondary loop, provide conductors for the welding current to the dial, make the dial plate of copper, water cool it, place the necessary welding dies on top of the plate and provide strippers or ejectors. The result is a resistance welding equipment that will produce 40 to 60 welded assemblies per minute.

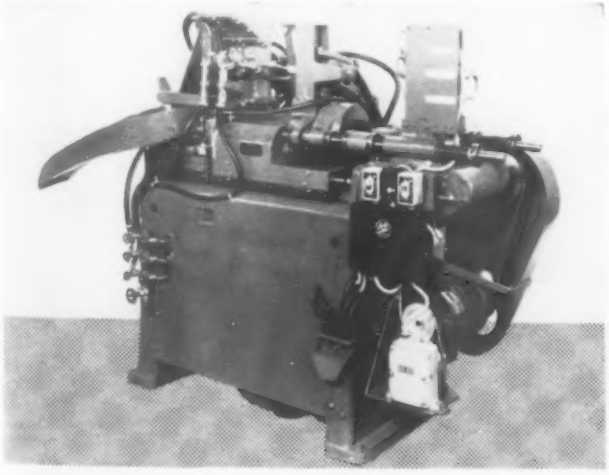
Time Factor Considered

There is no restriction as to the dial size. Most of them are probably too small. Since two or more pieces must be loaded and the welded part unloaded, three operators are sometimes used around a dial. Automatic ejection of the welded assembly eliminates one, and the other two can be eliminated by having automatic loading hoppers or magazines. However, the production of 40 to 60 per minute will not be materially increased by the use of automatic loading devices.

On the subject of machine speed and production, it may be well to give some attention to the time required to make a resistance weld. It is then easier to calculate the handling time—with and without fixtures, and more readily determine where fixtures are necessary, as far as increased production is concerned.

A spot or projection weld is made on any standard machine, with weld current flowing between 1/60 and one second, depending on the machine size. It is easily seen that

FIG. 9. Flash welder equipped with automatic loading, locating, welding and ejecting fixture. Workpieces are loaded in magazines.



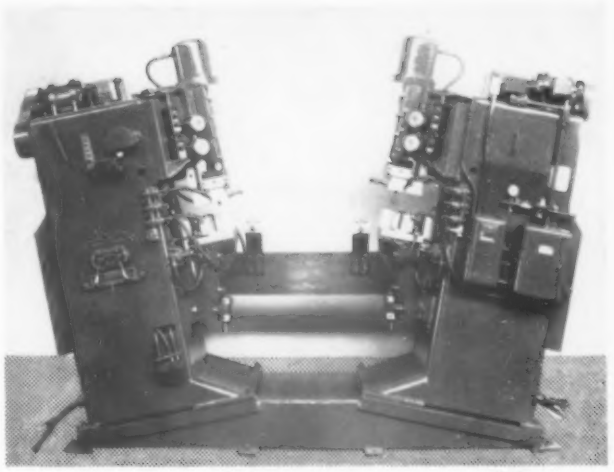


FIG. 10. Two press type welders mounted on sub-base to operate on the same piece of work.

for this type of weld the total production costs are almost entirely dependent on the fixture or jig that is used to cut handling time to a minimum production.

Seam welding is done at the rate of 3 to 30 feet per minute. As an example, on an 18-gauge, 36-inch long drum, the side seam is welded at the rate of 9 feet per minute, or in 20 seconds. If this shell has been previously tack spot welded, the operator merely places it between the welding wheels and starts the machine—unloading at the end of the weld. Here, because the loading and unloading time is so short as compared with the welding time, it is obvious that fixtures would be of little direct help in increasing the production.

Flash and butt welding vary greatly, depending on the work. Welding times are from 1 to 15 seconds on standard machines, and when increased production is required special machines are usually built. The methods of pushup, clamping pressure, preheating and annealing are so much a part of a flash or butt welder and the welding fixtures, that the need for special designs provides the necessary freedom to build a more suitable equipment, when the production per machine gets beyond the standard machine and clamp assemblies.

Capacities Should Be Known

It is essential to know the capacity range of resistance welding equipment, for both standard machines and the practical range for special machines. Otherwise a great deal of time may be spent on a job beyond which is not in the field of practical resistance welding.

The capacity in *stock* thickness for spot welding on standard machines is up to two pieces of ½" stock, and for special equipment two pieces of 1". This refers to *clean, low carbon* steel. The increase in pressure requirement beyond 5/16" stock is not uniform, but decreases in proportion as stock thickness increases. The current required would do the same, since increased capacity is obtained in this range by a longer and sometimes rather complicated current timing control during the welding cycle.

For seam welding, the range on standard machines is 1/64" up to ⅛" stock; and, using special equipment, about two pieces of ¼" stock is the practical limit, even at very slow operating speeds. Because of these speeds and the relatively expensive equipment required for 3/16 and ¼" stock, seam welding will only rarely compete with arc welding in this range.

For flash and butt welding, the capacities depend upon whether automatic or manually operated machines are used. Automatic equipment has a very much reduced capacity as compared to equivalent size of manually operated machines. For example, if an automatic machine has capacity up to

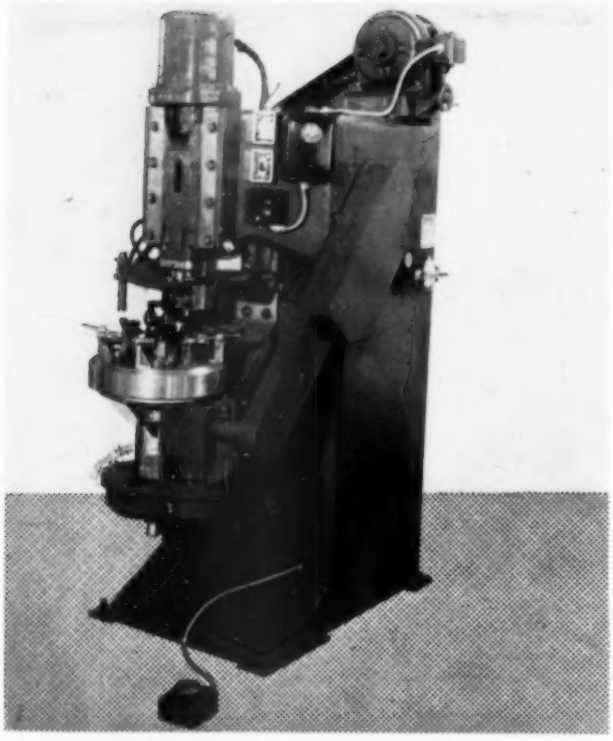


FIG. 11. Welder equipped with dial feed to increase production rate.

one square inch of cross section welded, a manually operated machine of the same size will usually weld up to three square inches. This difference is due to the "feel" of the operator during the welding cycle and the fact that the length of time can be varied for each weld during heating and final pushup on manual operation; whereas, with automatic equipment, the heating and upset pressure follows a constant and predetermined cycle, with little or no tolerance for variables, and the capacity is reduced.

Special flash and butt welders have a capacity of five square inches for automatic and ten square inches for manual operated machines. This increase over standard capacities exists mainly because flash or butt welders have not yet been standardized as thoroughly as the spot and seam welding equipment.

Power and Control Important

Pressure capacities required for various stock thicknesses are a good indication of a machine's capacity. KVA rating will also give this indication. Standard machines of recent date have a balanced electrical and mechanical design, so that usually if so many pounds pressure are available, the necessary electrical capacity is there also.

The electrical power and its control is as important in all resistance welding as the jig or fixture. Therefore the tool engineer should work closely with the electrical department to work out the final desirable balance between the mechanical properties of the machine, the jig or fixture used, and the electrical power and its control, for any specified high production job. Data is available for calculating electrically the capacity of any resistance welder.

Since we also resistance weld aluminum and its alloys, brass and other copper alloys, silver or gold, in fact any two pieces of similar or dissimilar metals that will alloy together and form a useful alloy, it is apparent that the range of tooling on standard equipment for improving machine production gives the tool engineer an almost unlimited opportunity to use his natural abilities in a greatly expanded field of usefulness. There is no greater need in the tool engineering field than for men who know this process of fabrication.

Fast Tapping on Tough Production Job

TAPPING SIX HUNDRED 11/16"-18 holes 2¼" deep in undrilled parts may be considered high production under any circumstances. But, when the tapping is complicated by an interrupting gap, the rate of output warrants more than usual attention. In this case, the job involves tapping both ends of die curled turnbuckles, shown at lower right in the photo. The parts are made of 1020 S.A.E. cold rolled stock and, due to the method of fabrication, tolerances have had to be fairly generous—i.e., .626 to .633 I.D. The stock is ⅛" thick.

The machine, which embodies a special multiple tapping head in combination with a turret type indexing fixture, was designed and built by Detroit Tap & Tool Company. There are three holding fixtures, spaced 120° apart and, in the cycle of operations, the parts are manually loaded, automatically tapped and automatically ejected. The taps used —also made by Detroit Tap & Tool Company—are the "M-11," made of a special chrome-cobalt alloy high speed steel developed by D.T.&T.

These taps were adopted as standard by the user—the Thompson Products Company, Detroit—on the basis of comparative production records. The "M-11" taps turned out 500 finished pieces per grind as against a previous average of 175; also, the number of grinds before the taps were scrapped was 8 as against a previous six.

Two machines are used—one for right hand tapping, one for left hand—and both operate at 250 rpm for tapping and 500 rpm for backing out. Currently, the machines operate three 8-hr. shifts with a total production of 24,000 turnbuckles, tapped both ends, per diem.

By **D. V. Waters**

Fundamentals of Machine Design Engineering*

Thorough Grounding in Engineering Fundamentals, Plus Creativeness And Original Thinking are Essentials for Successful Machine Design

THIS PAPER WILL DEAL with a few of the engineering fundamentals which underlie all successful machine designs. However, the field of machine design is so broad, and its ramifications so many and varied, that one cannot hope to do more than touch upon basic ideas, their relation to machine design; and to describe a few mechanisms which show how a competent design engineer can correlate such ideas, and put them in shape to be worked out in cold metal.

***D. V. Waters*, who has been directing machine design since 1920, is Chief of Machine Design Section, the Western Electric Company, Kearny, N. J. He was previously Head Designer with Gould & Eberhardt and Ass't Chief Eng'r with Ivers-Lee Company. A licensed professional engineer and a member of the A.S.M.E., Mr. Waters is also an instructor in the School of Engineering, Cooper Union, New York City.**

To digress for a moment, a knowledge of basic scientific and engineering principles, as taught in schools of engineering, is merely the groundwork upon which the young man going into machine design work will erect a superstructure of knowledge concerning the best ways of applying the things he has learned. He should possess an original and creative temperament and should be thoroughly grounded in engineering fundamentals, so that he will be capable of original and independent thinking and not be obliged to rely upon formulae and textbook statements, except as time and memory savers. Much could be said about this, but the general subject is outside the scope of this discussion and will not be dealt with further.

Let us ask ourselves "What is the most important requirement which must be met by a newly designed machine?"

Presumably, the correct answer to this question is that any machine must be functionally right; in other words, it must satisfactorily perform the operation or series of operations it was designed to handle. Obviously, a machine may be very finely proportioned and may incorporate most ingenious mechanical movements and highly perfected unit constructions, but these will be of little use to the manufacturer if it will not process parts of acceptable quality; attain satisfactory production; and be economical to maintain.

Motions and Mechanisms Come First

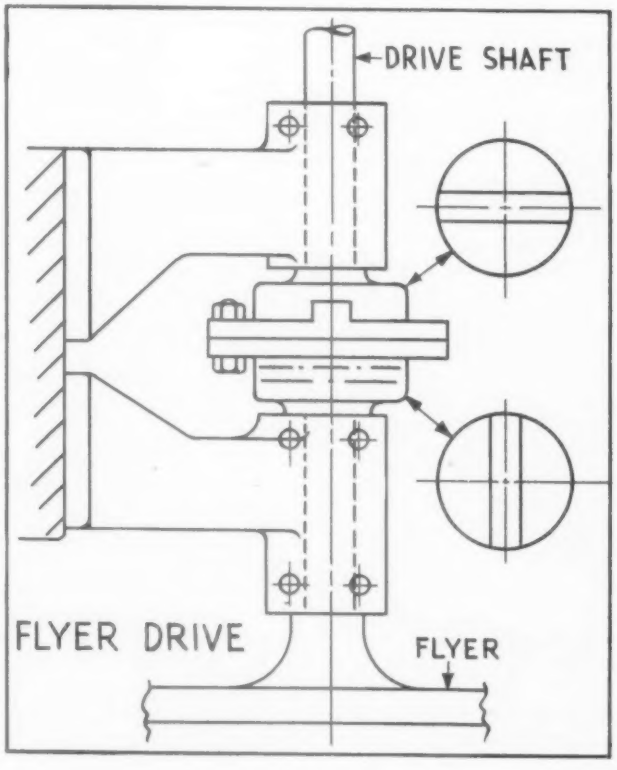
Any machine is a combination of the motions and mechanisms required to take care of a certain manufacturing process or sequence of operations. The initial planning and determination of just what these motions and mechanisms shall be, and how their respective performances shall be related, is the first—and probably the most important—step in its design. Of great importance, however, are the detail designs of the various unit assemblies, for it is here that a great measure of the difference between reasonable and excessive construction and maintenance costs, as well as the difference between good and poor performance, resides.

A machine should be designed for an expected service life. In other words, the conditions under which it will operate, or the probable length of time it will be needed, should be taken into account and a mechanism planned which will be good enough, but not necessarily too good. An example of this type of design is the automobile which, in normal times, is likely to become obsolescent both in appearance and performance in five or six years. Under such conditions, it would be uneconomical to design a vehicle which would be mechanically good for 12 or 15 years without appreciable trouble. However, other situations exist where the useful life of a machine may be 25 or 30 years, and in these cases the best known constructions are not too good.

The design engineer should endeavor to choose the simplest possible combination of mechanical elements that will satisfactorily perform the required function. It is an interesting fact, in this connection, that the mechanisms first conceived during consideration of a new machine are generally more complicated than those finally adopted after the designer has had time for more extended thought. It is generally true, also, that the machinery designed by older or more experienced men is simpler, with fewer parts to get out of order, than the machinery turned out by younger or less experienced men.

The designer should always keep in mind that any machine not only has to be assembled initially, but will have to be periodically taken apart and put together again to permit maintenance work to be done. It is necessary, therefore, that the machine be planned with maximum accessibility of the different functioning parts in mind, and that its arrangement be such that it may be disassembled by units rather than by individual pieces.

FIG. 1



*This paper was originally presented at Montreal Chapter, *A.S.T.E.*

This permits the parts to be fitted and assembled at the bench—or where most convenient—and also permits the complete unit to be put in place with the minimum interference with work on adjacent machines. Units can also be removed for cleaning, adjustment, repairs, or for the replacement of spare units with very little loss of time. For example (see Fig. 1), where a unit mechanism is installed with shafts protruding into other units, its removal from the machine will be facilitated if couplings of the face-to-face type are used to join the shafts at the points where they must be broken to permit removal of the unit. Several firms market couplings of this type as a standard article.

Nature as a Source of Design

It goes without saying that all the component parts of a machine should be designed amply strong for the service expected of them, as breakdowns of machinery generally mean not only maintenance expense but irritating and expensive losses of production at times when the equipment is badly needed to maintain output. Nature has given the design engineer some aid in proportioning his structures and selecting detailed sections to secure necessary strength with good appearance, as the basic shapes and forms occurring in nature are generally those best adapted to withstand operating stresses in machinery.

Examples of this include the cylinder, or tube, which takes care of both torsional and certain flexural loads with the least amount of material; and the ellipse which, when utilized for the rear contours of planer or gear cutting machine stanchions or, for example, the lower sides of bridge crane girders, provides a member which is both good looking and of substantially uniform strength throughout its length.

Correct choice of materials is of vital importance in the design of machinery and is closely related to the question of adequate strength of parts. Serious thought should be given to the balance between the cost of a material and its economical value in the machine; and material should be chosen with consideration given to the extent of benefits to be realized from its use. In the interests of cost, and time required for procurement, the more common stock materials should be used wherever possible. However, the designer should not hesitate to use a higher grade material if he deems it desirable to do so; and he should have a comprehensive and detailed knowledge of the processing sometimes required to bring out desired properties or characteristics of the metals he specifies for use in such machines.

Choice of Material for Hydraulic Press

As an example, there is a large hydraulic press in which a good portion of the force developed is imposed upon a single steel center column. By making this center column of high grade nickel chromium alloy, heat treated to secure a very high elastic limit, it was possible to use a column about 3" less in diameter than would have been required if the column had been made of mild steel. This saving in column diameter permitted the press to be made several inches shorter with a corresponding reduction of first cost, and floor space occupied. Incidentally, the lesser cost of a smaller roller bearing, used with the smaller column, was sufficient to offset the greater material cost of the alloy steel.

In another instance of careful choice of material to improve the operating characteristics of a mechanism, it was necessary, on account of an existing centrifugal condition, to run a pair of right angle helical gears without lubrication and to transmit considerable torque at an appreciable pitch line velocity. One of these gears was made of hardened steel with polished tooth surfaces, and the other gear of a phenol muslin plastic containing approximately 11% graphite. The coefficient of friction between the contacting surfaces was nearly the same as if they had been made of steel and cast iron, lubricated; the rate of wear was low; and the drive proved to be entirely satisfactory.

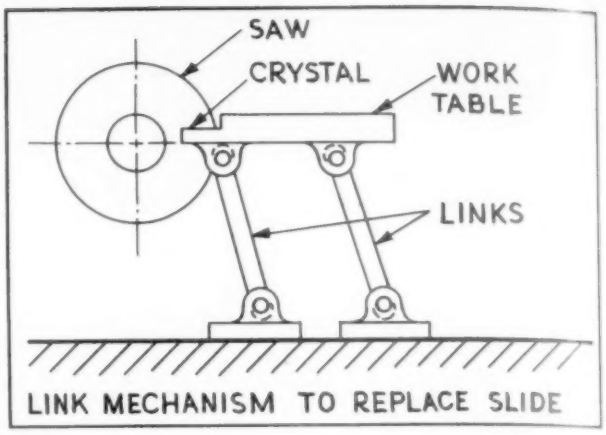


FIG. 2

Use of Links and Indexing Devices

Certain fundamental ideas and constructions are common to machinery of different types and uses, and we will discuss briefly a few "preferred" ones which have satisfactorily withstood the tests of time and use. For example, the slide has long been used when rectilinear motion of a machine element is desired; and it is simpler and cheaper to build and maintain than any one of the several straight line motions which utilize special arrangements of levers and links. However, if a machine element or mechanism must occupy a certain position at only two points of its travel, its exact location at other points of its travel being immaterial, a simple arrangement of links can be substituted for a slide (see Fig. 2).

Links generally result in a mechanism which is less expensive to construct, operates with less friction and looseness, and is easier and cheaper to maintain than a slide. Especially so if subjected to abrasive atmospheres or fluids, since relative movement takes place between pins and bushings, antifriction bearings, or cone type bearings—any of which is easy to seal against the entrance of foreign matter or the escape of lubricant.

Formerly, the relative motion of contacting frictional surfaces was much used as a means for energy transmission or absorption. A typical example of the latter is the huge rope hoist, equipped with friction band brakes, which is used to control the descent of ore cars into mine shafts. If electrically driven, such a mechanism as constructed today usually incorporates regenerative braking to control the descent of the mine car. The magnetic pull, which produces retarding torque at the winch axis, operates across an air gap with no physical contact; it is smooth and uniform, easy to control, and subject to no deterioration or wear.

Indexing or "step-around" devices have been used for many years and utilize several different basic mechanisms as the ratchet, the Geneva stop and cams of various types. Each one of these mechanisms has its place, but it has been found that for a number of stations greater than 8, the cylindrical cam-type of indexing mechanism can be designed to provide a wide variation in the type of motion imparted to the cam follower and can be operated at higher speeds than most other indexing mechanisms.

The transmission of motion or energy from one machine member to another can be accomplished either positively or non-positively. Among the positive mechanisms may be mentioned gears, chains and levers, while the non-positive mechanisms include belts of various types, hardened steel friction surfaces running in oil, and metal wheels running against faced friction discs or wheels.

Any toothed gearing member transmits power or motion smoothly in a relative sense only, as there are minute acceler

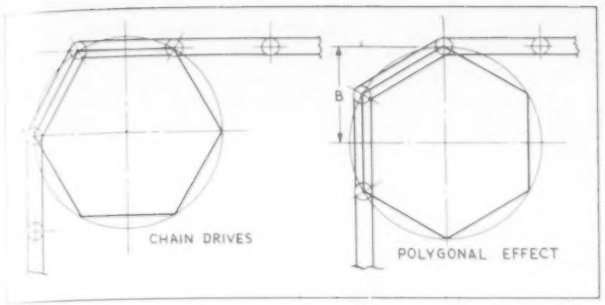


FIG. 3

ations and retardations occurring throughout each revolution or cycle of the mating members. These inequalities appear in the driven member as periodic variations of angular velocity which, of course, are very small in accurate gears, but are most detrimental to the satisfactory operation of certain types of precision machines.

Non-metallic gearing can be advantageously used in places where tooth loads are not too high, and where quiet operation and freedom from the need for lubrication are desired. Materials used for such gears include molded phenol fiber, canvas and muslin, with or without a graphite content; rawhide; and oil soaked muslin discs compressed between steel shrouding plates. The latter type of gear, which is commercially available, approximates cast iron in strength, is long wearing and is much used where space for the shrouds is available.

Chain transmissions require less accurate arrangement and location of centers than an equivalent gearing mechanism. Either side of the chain may be utilized and special types of chains incorporating lugs, pins, pallets and so on are available for specific uses. However, the "polygonal effect," whereby the effective lever arm at which the sprocket is driving the chain varies as the successive tooth centers or space centers become tangent to the chain line, is inherent in all chain drives (see Fig. 3). This effect produces acceleration or retardations, in the angular motion imparted to the driven sprocket, which increase in magnitude as the number of teeth in the sprockets decrease. This characteristic of chain drives should be kept in mind when planning such mechanisms.

Advantages of Belt Drive

While levers and link-work provide the most positive drive from one member to another and can be made substantially free from backlash, such mechanisms have a relatively limited arc of action. A variation (see Fig. 4) of this type mechanism utilizes discs with smooth peripheries, thin flexible steel tapes anchored to the discs; and it provides positive, and extremely uniform motion, free from backlash, from one member to another through an arc of nearly 360°.

Mechanisms which transmit power or motion by means of frictional contact, are inherently smooth in action and are preferred when exact timing or synchronizing of motion between related machine members is not essential. For instance, the use of a V-belt drive instead of a geared or chained drive usually permits the placing of drive motors in more advantageous positions, materially reduces the loads on bearings, eliminates the need for lubrication, and obviates the necessity for accurate alignment between machine units. Special variations of the V-belt drive are used as the transmitting medium in several different types of variable speed transmissions available as commercial stock units. Unfavorable characteristics of the V-belt drive are that it is relatively inefficient, and not as smooth as sometimes required.

Variable speed transmissions which transmit torque by frictional contact between hardened steel revolving members operating in an oil bath are marketed by at least three manufacturers. These units are about the same size as squirrel cage electric motors of equal ratings, are totally inclosed, require little attention, and are widely used. The application of this type of power transmission unit must be carefully engineered, as it has been found that an overload, continued for any appreciable time, results in various maintenance troubles, ending in complete failure.

Effects of Temperature

The operation of certain mechanisms results in their component parts being subjected to extreme ranges of temperature. The designer should consider the stresses or changes of dimensions which attend these thermal changes and should make sure that the mechanism will stand up under such service. For example, a large gas-fired, lead melting kettle was equipped with a vertically and centrally disposed stirring device which consisted of a small propeller running within a tube and driven from the top of the kettle.

The molten lead was drawn in at the bottom of the tube and discharged through radial holes at, or near the surface of the pool. The change in dimension of lead and cast iron for an equal temperature change being quite different, trouble was experienced when the kettle was alternately heated and cooled, as it was virtually impossible to keep the central tube (before mentioned) from being torn loose from its fastenings. This condition was finally ended by a change in design which mounted the tube between heavy springs so that it could move axially a small amount without injuring the adjacent parts which held it in place.

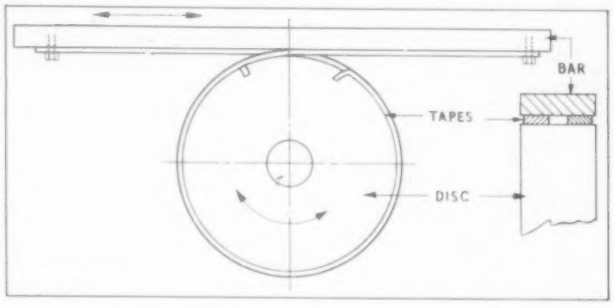
Bearings

Choice of proper bearings is of vital importance in the design of machinery and should be carefully considered early in the progress of a design job. Twenty-five years ago, both precision and high production machines were designed to incorporate plain or sleeve type bearings. Even today, plain bearings are used where special requirements of performance or operation must be met. For instance, it has been found that a hardened steel sleeve very closely fitted into a hardened steel bushing, and force lubricated, is probably the best bearing for the hob spindle of a gear cutting machine. Special radial bearings, incorporating tilting shoes which operate to form a wedge-shaped film of oil between the bearing and shaft—as in the Kingsbury bearing—are installed on the spindles of certain centerless grinding machines which must produce extremely smooth surfaces. Additionally, various non-metallic bearings developed to operate without lubrication, or with water lubrication to withstand abrasive conditions and so forth, are also available.

Anti-Friction Bearings

Modern machines, particularly the high production type, usually incorporate so-termed anti-friction bearings in places where appreciable power is transmitted and where reliability in operation is required. Anti-friction bearings of many types are available, ranging in size from a radial bearing of .040" bore x 1/8" outside diameter with eight 1/32" diameter balls, to double row tapered roller bearings have a 5" bore used on the work spindle of a large gear cutting machine. Bear-

FIG. 4



ings of dimensions outside of the range just indicated are available on special order.

Among desirable characteristics of the anti-friction bearing are its low starting friction, which differs little from its running friction; the facility with which the anti-friction bearings may be installed and replaced when necessary; and the better maintenance of shaft alignment realized, even after long service.

Contributions of Welding

During the past 20 years, the development of acetylene and arc welding has made great progress. As a result of this, the machine designer has been able to use welded steel construction in places where such construction was formerly deemed impracticable; for, before the advent of modern acetylene and arc welding techniques, steel shapes or plates could not be neatly and economically joined.

Rolled steel is about three times as strong as cast iron in tension, resists compressive forces equally well, and is two and one-fourth times as stiff as cast iron. This does not mean, however, that full advantage should always be taken of the superior physical qualities of steel when substituting it for cast iron constructions. If machine parts, made of rolled steel shapes or plates suitably welded, were proportioned with only unit stresses in mind, they would probably lack rigidity, as the various sections would be too thin and the spacing of reinforcing members, and so forth, inadequate to hold deformation under flexing and compressing loads within permissible limits.

Also, the lack of sufficient mass would increase whatever vibration might be present. It is, therefore, often necessary to put extra material into such constructions in order to keep down distortion or vibration, which, of course, increases the safety factor over that generally allowed for equivalent cast iron mechanisms.

Many mechanisms, however, present real opportunities for the utilization of welded steel construction with its attendant advantages. It is the favored material from which to build large machines for which pattern and molding costs would be high—machines, such as punches, shears, and presses, built to withstand definite and frequently imposed stresses. And, in general, this is true for any machine whose frame contains little mechanism but which provides something upon which the different machine units may be suitably mounted and which, especially, is to be built in limited quantity. Cleaning, smoothing and filling, which constitute no small part of the cost of each casting, are eliminated, as well as some departures from theoretical sizes, due to shrinkage and warpage. In some cases, considerable machine work is saved.

Design for Welded Steel Construction

To satisfactorily use welded steel construction for large machine parts, a type of design quite different from that used with cast metals should be employed. Consideration should be given to the applied loads in much the same way that a bridge truss is designed, if maximum economy of material is to be secured. Standard rolled shapes, such as angles and channels should be used as much as possible, and it is good practice to make stiffening members of steel tubing or extra heavy pipe welded in, as these shapes are excellent for withstanding torsional strains. Straight lines and simple framing, with few bearing bosses, are of more importance than in an equivalent cast part, as the additional cost of a complicated structure is present in each machine, instead of being absorbed once and for all in the cost of a pattern.

Having determined the general outline and the maximum loading which may be imposed upon a given machine frame or component part, its various members should be so located that, as far as possible, they constitute a triangular system of bracing. Load lines and reactions leading to a given junction should intersect at the same point in such a way that they are transmitted as simple axial stresses without bending. Sections should then be selected that will hold stresses and deformations within allowed limits, and the members placed with their gravity-axes coincident with existing force lines.

Sections should preferably be symmetrical, and when it is necessary to use unsymmetrical shapes, special attention should be given the end-connections to avoid complex stresses due to eccentricity. In many cases, of course, the plate walls of a machine frame, with simple corner gussets and web stiffeners, provide all the strength and rigidity required. It is important that welded steel structures of any complexity be stress relieved after fabrication has been completed.

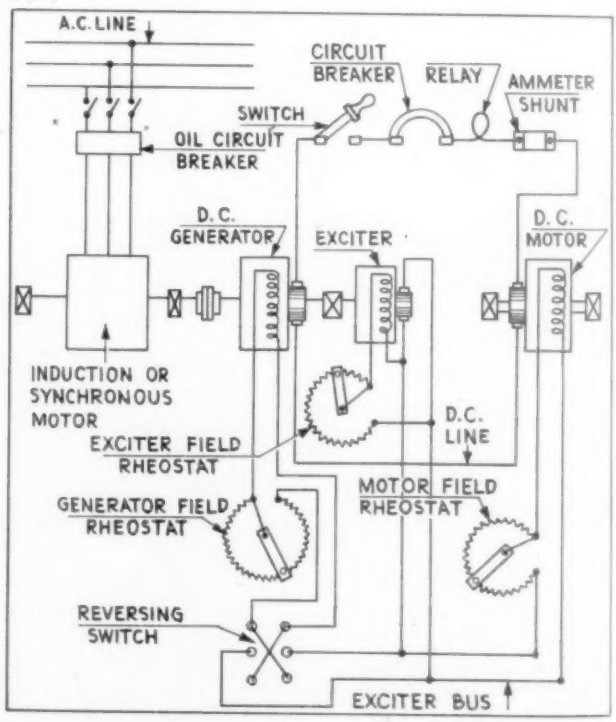
In general, when planning welded steel machine designs, care should be taken to avoid constructions which cannot be satisfactorily or economically produced with the welding personnel and technique available. It is obvious that more elaborate welded constructions could be satisfactorily carried through a shop having a well-trained sheet metal forming and welding personnel than in a shop which does not handle much work of this kind.

Standard or Stock Mechanisms

No doubt, the application to special equipment designs of commercial items is a matter of standard practice with most design engineers. However, the importance and advantages of utilizing such equipment in special machine designs are so great that periodic consideration of the subject seems justifiable.

Commercial devices may be divided into two classes: *first*, standard details which are selected by the design engineer and worked into his designs; and *second*, standard or stock mechanisms which are selected usually in collaboration with the outside supplier and which may constitute a substantial part of the machine being designed. The supplier of the first class of item is usually responsible for the functioning of his products only if they are used in a conventional way and published ratings are not exceeded, the designer being responsible for proper selection.

FIG. 5



The firms which supply complete mechanisms should, and usually do, aid the designer to select the right unit to handle the work to be done and carry at least an equal share of responsibility for its successful performance when incorporated into the machine. This arrangement is especially advantageous to the designer, as he can use the ability and experience of specialists who have developed the unit he is using.

It is obvious that a commercial detail or mechanism can be provided for use in a machine for only a fraction of the amount it would cost to design and fabricate a special item or device to do the same work. Of course, in attempting to secure such economies, the design engineer must not sacrifice either operating efficiency or quality of product. He must possess an intimate and comprehensive understanding of the essential functioning of the machine he is to design and should also have a broad knowledge of commercially available machine details and devices, and sound judgment concerning their capabilities and limitations not only in the field for which they were developed but often in some field not previously considered for them.

Keeping Up-to-Date

How, then, is the policy of designing commercial mechanisms into special machinery to be carried out most effectively and intelligently? By acquiring, and keeping up-to-date through the aid of catalogs, technical literature and personal observation, information on any manufactured products that may have possible applications to machine design, and scrutinizing each new design for opportunities to use commercial products to advantage.* In doubtful cases, the service requirements and the characteristics of the particular unit and its relations to other parts of the machine should be carefully weighed before accepting or discarding it.

Until a few years ago, mechanical equipment incorporated mechanisms in which most functions, including timing relationships, were worked out mechanically or hydraulically. However, with the conception and development of new and improved electrical theories and devices has come an appreciation of the simplicity, economy, and sureness of operation which can sometimes be realized by the use of these electrical devices in machinery instead of mechanical constructions.

Formerly, the primary drive to a machine usually incorporated a constant-speed electric motor, and if it was necessary to operate the machine at various running speeds, change gearing of either the pick-off or the quick change types was used. Such arrangements were not very efficient, and the cost of maintaining them in operating condition was high. Direct current adjustable speed motors were sometimes used; but such prime movers were heavy, costly, required a bank of resistances with attendant dissipation of valuable power in the form of heat, and the speed variation obtainable was in relatively large steps with all changes made by hand.

Ward-Leonard System

Nowadays, the Ward-Leonard system of electric drive is widely used; for, an extensive range of operating speeds, as well as a low jogging speed, can be easily obtained by adjusting the field and armature voltages of the motor-generator set, and machine driving motor. Remote adjustment of such a machine drive is easily accomplished by means of a suitable control circuit (see Fig. 5) and the functioning of other members or mechanisms of the machine can be controlled by utilizing the available voltage of the driving system in connection with suitable overload relays. Such a drive also fits in well with present power supply systems, which usually are alternating current.

The Ward-Leonard system of electric drive very adequately takes care of acceleration and deceleration requirements, as it is an easy matter to incorporate a motor driven rheostat to control the voltages of the motor generator set and machine driving motor. The rheostat is usually actuated by a small adjustable speed d.c. motor with hand rheostat control so that any desired acceleration or deceleration time can be easily and quickly obtained. Also, if it is necessary to control electric circuits governing other machine functions at certain times during the acceleration or deceleration of the machine, it can be easily accomplished by providing additional contacts at the proper places on the motor driven rheostat.

Tensioning Devices

Mechanisms used to process a strand of any sort, whether it be textile or metallic, usually incorporate a device which takes up or winds the strand upon a suitable spool, reel, or coiling device; and the drive to this mechanism is generally arranged to provide a substantially uniform linear tension in the material being taken up. Any takeup tensioning mechanism maintaining uniform linear tension in a strand is inherently a constant horsepower device, as the product of the strand tension and strand speed is constant. This means that the torque impressed upon the takeup reel must, at all times, be inversely proportional to its rotational speed which, in turn, is inversely proportional to the diameter at which the strand is being wound upon the reel.

Mechanical (see Fig. 6) and hydraulic strand tensioning devices have been used for many years and can be designed to operate satisfactorily. However, both alternating and direct current electrical strand tensioning devices (see Fig. 7) are in successful operation and offer definite advantages of simplicity, low maintenance, adaptability to high speeds and fewer locational limitations as compared with mechanical or hydraulic devices. This, however, is a topic in itself and will not be expanded on at this time.

The interlocking of the separate functions of a machine, so that they will occur in the proper sequence, or so they

*The several departments in *The Tool Engineer*—as the "Tools of Today" and "Bulletins"—together with technical articles and the advertisements, should keep the reader abreast of current developments. All of this material makes good reading.

The Editors.

FIG. 6

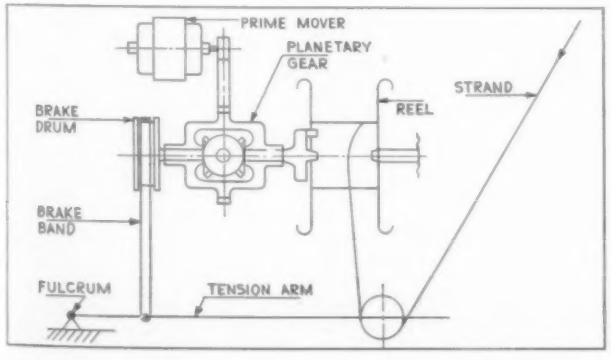
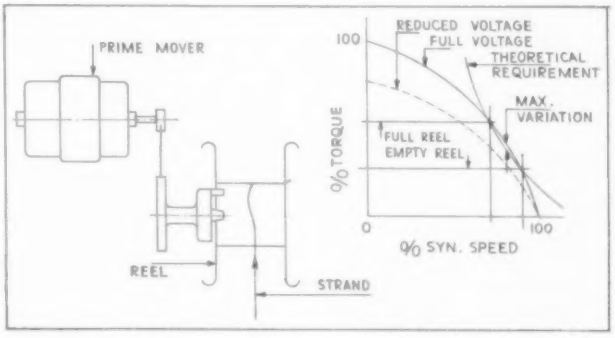


FIG. 7



will not occur until some operating machine condition has been satisfied, presents many instances in which electrical devices can be advantageously used. It is difficult and expensive to provide mechanical interlocking between two machine members which may be widely separated, or located in different planes. For instance, in a certain twisting machine, a high speed revolving member was enclosed by a heavy machine frame having openings covered by hinged doors.

This machine incorporated a fly-ball centrifugal device which insured that the doors were locked shut until the high speed machine member had practically come to rest, and the machine starting mechanism was so arranged that it could not be operated unless the doors were closed. The mechanism installed in the machine to take care of these functions was expensive both to build and to maintain, and was not absolutely certain in operation.

These mechanisms have been superseded, in more recent designs, by a very simple rotating electric switch which takes the place of the centrifugal mechanism before mentioned, and which can be purchased from stock. The door locking bolts are operated by commercial solenoids, and the entire mechanism is simple, very dependable and inexpensive.

The comfort and convenience of the operator should be given careful consideration early in the design of a machine. The design engineer should make sure that such things as control handles, buttons and knobs will be conveniently and centrally mounted and that seats, platforms, steps and the like, are of suitable locations and heights. The physical effort required to load, operate and unload the machine should also be kept as low as possible. Time spent on such matters will be well repaid in heightened operator morale and increased output.

Reduction of Operational Risks

The minimizing of operating risks should be a major consideration in connection with the design of any machine, however simple. As an example, in a paper read before the National Safety Council, Mr. L. A. De Blois of the Du Pont Company brought out the fact that the methods employed in safeguarding mankind against hazards due to modern industrial conditions may be classified under three distinct headings; namely, Prevention, Education and Elimination.

To illustrate his point he made use of the railroad grade crossing as an example. The provision of gates at the crossing is Prevention, but is not entirely satisfactory as the gates are not always lowered at the proper time. The publicity given by the railroads to the necessity of stopping before proceeding across the tracks is Education, but people are hard to educate. The only sure way of doing away with grade crossing hazards is by removing the hazard; that is, by elevating the tracks. This is Elimination.

The machine design engineer contacts the general safety problem along the lines of Prevention and Elimination. In his case, Prevention consists of providing machines, which have already been built, with guards. Elimination consists of so designing new machines that the hazards connected with their operation are eliminated; or, at least so that complete protection is afforded the operator by suitably placed controls and guards incorporated in the original design. Elimination is by far the more important of the two methods and should be a major consideration in all original designs.

For Appearance Sake

A machine should not only function correctly and be economical to build and maintain, but it should present a good appearance. Undoubtedly, any machine is more saleable if carefully designed with attractive contours, covered with an attractive coat of paint. The saying that "when a thing is basically and mechanically right, it is pretty sure to look right also," is applicable today.

The general appearance of a machine is the sum total of the appearances of the units of which it is composed, plus certain general features such as its general type or shape, its color, and so forth. The general outline of a machine will be largely dependent upon the arrangement and outline of the frame, and one or two principal members. In fixing the outlines of these members to secure the best appearance, the natures, magnitudes and directions of the different machine movements and working stresses are roughly determined.

Shapes are then chosen which, as nearly as possible, conform to those best adopted to take care of the required movements, and to satisfactorily withstand these stresses. An axis is determined, and an attempt should be made to group the various units and components of the machine about it in a symmetrical and harmonious manner. The appearance of a machine largely depends upon the extent to which this law has been followed by the design engineer. One has but to look at a steam locomotive to see how it works out in actual practice.

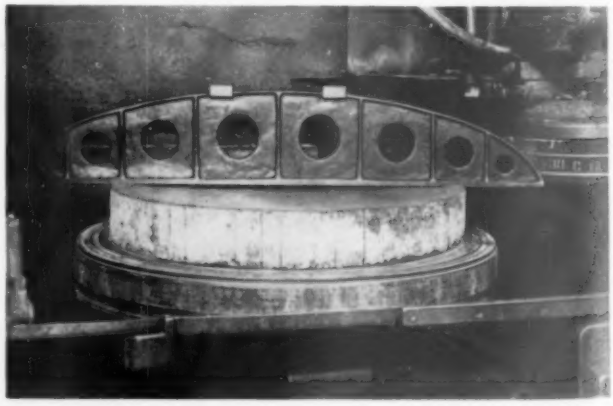
The foregoing discussion, brief as it is, indicates that any successful machine is the end result of careful consideration of a set of requirements, and the exercise of sound engineering knowledge and vision, combined with judgment and experience.

Optical Mirrors Ground on Blanchards

ORDINARILY, one would consider a grinder of the Blanchard type as a mass production tool for finishing to close limits of tolerance. That it is also suited to special jobs is evidenced by the flat and concave grinding of the 30" x 6" Pyrex glass discs for the optical system of the new, high velocity wind tunnel at Langley Field. For this grinding, which requires an accuracy of three light bands, Dr. Duncan E. MacDonald, director of the B. U. Optical Research Laboratory, turned to the Blanchard Machine Company, directly across the river in Cambridge.

The grinding was done on a standard Type 18 Blanchard Surface Grinder, with 48½ pounds of glass removed from one casting, and 60 pounds from the other, in less than 26 hours. This saved the lab at least 160 hours of labor which would ordinarily have been required. After grinding one side flat and the other concave, final polishing was done under Dr. MacDonald's direction in the B. U. Laboratory.

The application of precision mass surface grinding methods of metal working to glass, quartz, sapphires, ceramics and similar substances provides an entirely new vista to these fields. In optics, the rapid removal of material effects economies previously unattained. When applied to the production of quartz crystals for radio frequency control, for example, from 1600 to 2000 separate surfaces can be ground per hour to tolerances within ± .0002".



By James Walker

Drawing Die Problems and Formulae

A Comprehensive Treatise Covering Advanced Design and Construction Of Simple and Compound Drawing Dies for the Mass Production Industry

Installment No. 4 of a Series

THE USES and heat treating of tool steels is a broad subject, the mastery of which requires much study; nevertheless, every individual concerned with any of the phases of tooling should have some basic knowledge in order that he may make the proper selection for the specific job, and especially so for punches and dies.

While there are many good tool steels available today, manufactured by various companies, the Carpenter Steel Company published, in 1937, a book called "Tool Steel Simplified" which is so informative that it is hereby recommended as supplementary reading to this series. In this book, the Carpenter Steel Company gives instruction in the selection of tool steel for a specific job by the chart shown in Fig. 33. This refers to the "matched set" method.

"Know-how" an Essential

It is evident that while the tool maker—or anyone concerned—need not have an intimate knowledge of tool steels, *he must nevertheless know his tools.* Being itself in a sense a tool, the matched set must be used with the same intelligence and good judgment exercised in the use of any of the actual tools in the shop. And finally, changing tool steels should be resorted to only after it is reasonably certain that failures are not due to such things as faulty designs, improper heat treatment, or accidents that are bound to occur in service. After all, there are only four basic reasons for changing tool steels—to secure greater wear resistance; to secure greater toughness; to be assured of hardening accuracy and safety during quenching; and to secure greater "red hardness."

All tools should be made from a tough-timbre—high-carbon water-hardening tool steel unless there is a good reason for not doing so. For example, if the tools present no cracking hazards in heat treat (abrupt or sharp corners), or if the contours can be readily ground as is the case in cylindrical work, then use water-hard. A tool maker or designer should not think of water-hard tool steel as "just another steel"; he should always think of it as a good starting place when selecting the proper tool steel. One of the important reasons for selecting water-hard steel is that it is the most economical tool steel. If for any reason this steel fails to answer the purpose, there are four directions to follow, and these are aptly illustrated in Fig. 33a.

To clarify the charts, a few examples will be given. If the steel in the center of the chart (water-hard) were selected as the material to construct a tool, and the tool chipped in service, a greater toughness would be necessary. The chart in Fig. 33a says: "If greater toughness is needed, travel south"; the selection then would be water-tough. Water-tough is one of the toughest tool steels known, and is recommended for tools that have to withstand shock or impact, e.g. long slender punches or tools with fragile projections, ejecting fingers, indexing pins, chisels, beading tools, coining dies, heavy duty forming and bending dies, etc. One important thing to note, at this time, is that wear resistance must be sacrificed to be assured of greater toughness, and vice versa.

In the event that tools "foul" or "gall" in service, a greater wear-resisting tool steel is needed. For example, if the center tool steel (water-hard) is unsatisfactory, then travel north for greater wear resistance.

If an intricate shaped tool were the case, and the tool presented a heat treating problem, travel west for greater safety and accuracy. The same would apply to the oil hardening group of steels, as in the cases of water hardening steels previously discussed. Travel north to get wear resistance, and south to get toughness. In the oil-hardening group, oil-hard will be found to be an easy machining, non-deforming, general purpose tool steel. Many small shops use

Note: All illustrations, this installment, by courtesy of Carpenter Steel Company.

FIG. 33.

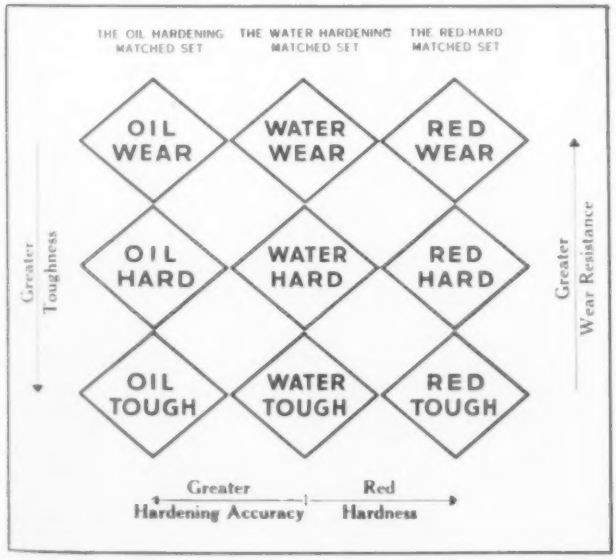
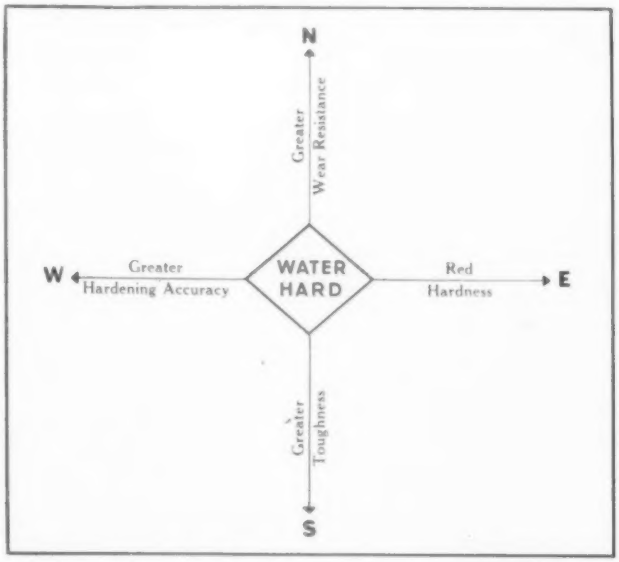


FIG. 33A.



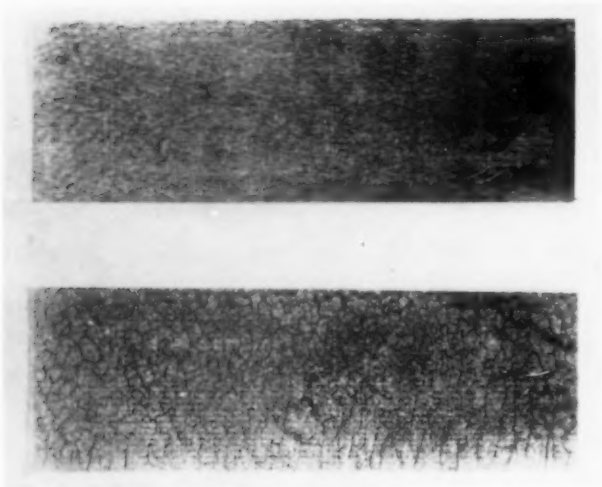


FIG. 34.

this steel exclusively. It is an excellent tool steel for constructing intricate shaped dies, either blanking, forming or bending, master gages, broaches and precision tools.

For dies that become hot during service, such as magnesium drawing dies, or dies that receive heated parts previous to forming or drawing, then it is better to use the red-hard tool steels shown at extreme east in Fig. 33. The red-hard steels are used for such tools as gripper dies, hot extrusion dies, hot piercing punches, bulldozer tools and forging mandrels.

An important consideration, relative to hot work steels, is that when large dies are required it is usually more economical to switch from the average run of tool steels to a casting alloyed to withstand the heat. Castings are suggested because of the initial cost of the red hardening forgings; however, it were well to consult the steel companies for suggestions.

Grinding Checks

A grinding wheel produces intense local heat. This is obvious from the manner in which the tiny particles removed become white hot and burn up (grinding sparks). If the little chips that are removed get this hot, the spot from which they were torn must also attain a considerable temperature. These spots are, of course, instantly cooled by the surrounding metal and the coolant. If the action is very fast, and the temperature not too high, the ground surface will show no color. Under severe conditions, however, a bronze or blue temper color may be produced. When steel is heated, it expands, and when cooled it contracts. Thus, a surface that is being ground is continually expanding and contracting which causes rather heavy strains to be developed momentarily on the surface of the metal. If the strains are not too great and if the steel is tough enough, no permanent injury is done. Sometimes, however, tiny cracks will form on the surface of the steel, as shown in Fig. 34, and these are known as grinding checks.

The proper selection of tool steel for the draw-ring shown in Fig. 35, would be Water-Hard, because the draw-ring presents no cracking hazards in heat treating, and it is quite simple to grind after hardening. Fig. 36, illustrates a curling die shown at A, with the mandrel shown at B. The punch is not shown. The tool steel best suited for both the die and mandrel is Oil-Tough, because both components are of intricate shape and present a heat treating problem and, in case warping occurs, they would be very difficult to further machine.

Fig. 37, illustrates an interchangeable stamping die for marking brass and steel strip. Since the die is a perfectly flat plate which involves no other requirement but hardness, the proper selection of tool steel is Water-Hard. As the punch is slotted to receive the stamps, difficulties are apparent in heat treating and Oil-Hard is the proper selection of tool steel. If the screw holes in the stamps constitute a hardening problem, quench only the face and let the balance of the stamp remain unhardened.

The plate shown in Fig. 38 is 45% carbon steel 1¼" square, and while three sides of the punch are cutting through 1¼" metal, the fourth side is cutting 13/16" metal. Since greater toughness is necessary and no heat treating problems present themselves, the proper tool steel for this job is Water-Tough.

The escutcheon die, shown in Fig. 39, is made of five sections—three for the die and two for the punch. The part shown is about 18" long. Most escutcheon dies are made of water-hardening steel; however, if an inexperienced man were confronted with a similar job, he would be better off with an oil-hardening steel (oil-hard) to eliminate warping.

A set of gripper punches and dies for hot upsetting a special steel wrench is shown in Fig. 40. Note: On further acquaintance with the Red-Hard tool steels, it will be found that Red-Wear is not tough enough to even be considered for making dies of this sort (although possibly suitable for the punches). Therefore, when selecting a steel for hot forging tools, the choice lies between *Red-Hard* and *Red-Tough*.

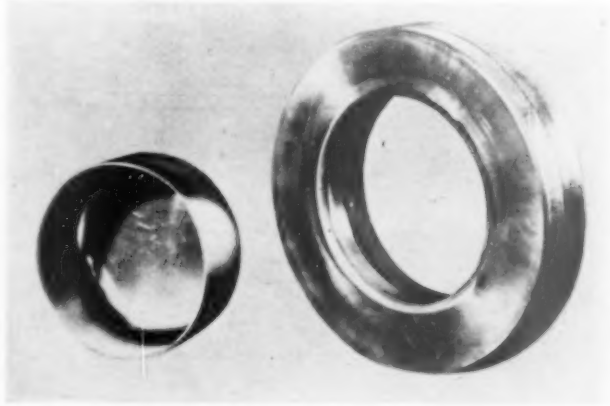
The rolls shown in Fig. 41 presented several manufacturing problems before the proper selection of tool steel was made. The rolls, 3" in diameter, are used for rolling a bead on stainless steel strip .008" thick. Note the thin edge on the bead. The first selection of tool steel was Water-Hard; however the bead cracked during heat treating. The second selection of tool steel was Oil-Hard, but when the rolls were placed in service the strain was too much for the thin sections in this hard steel, and the edges chipped. The third and final selection was Oil-Tough, and the rolls had produced "miles of molding" when this photograph was taken.

Analysis of Tool Steel

It is not necessary for the average tool and diemaker, or for the designer, to know or to specify the correct analysis to tool steel; however, he should be familiar with the average alloys that are added to supply his wants. In presenting the analysis of a steel, it is not uncommon to use the chemical symbols instead of the full names of the elements. A list of the usual elements, with their symbols, is given in the following table:

Name of Element	*Chemical Symbol*	*Name of Element*	*Chemical Symbol*
Iron	Ee	Chromium	Cr
Carbon	C	Nickel	Ni
Manganese	Mn	Tungsten	W
Silicon	Si	Vanadium	V
Phosphorus	P	Molybdenum	Mo
Sulphur	S	Cobalt	Co

FIG. 35.



Alloying elements are added to tool steel during the process of melting. Sometimes, suitable alloy steel scrap is used in the original charge so that only final adjustments need be made to secure the exact percentage of each element required. In either event, the alloying elements are thoroughly and completely mixed throughout the bath. With a few exceptions, alloying elements used by the steel maker are in the form of *ferro-alloys*—that is, the alloying element is already combined with a certain percentage of iron by the maker of the ferro-alloy. For example, silicon is added to the steel in the form of ferro-silicon, and contains approximately 50% silicon and 50% iron.

It might be well to inquire "why alloys are put in tool steel"? Carbon, of course, is necessary in order that the steel may harden. Plain carbon tool steel is as old as history itself—dating back no less than three or four thousand years. Alloys to augment carbon have been introduced during the past fifty years, and are shown in Fig. 42.

The Effect of Alloys

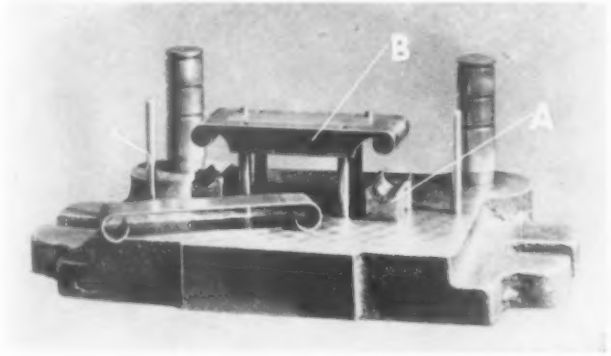
If plain carbon tool steel had been perfectly satisfactory for all tooling problems, there would have been no need for alloy steels. Alloys are put into steel to enable it to do things that a plain carbon steel cannot do. Strangely enough, these extra requirements can all be assembled under four heads.

1, To secure *greater hardness* for cutting or wear resistance; 2, to secure *greater toughness* or strength; 3, to make steel *hold its size and shape accurately* during hardening, or to make the *hardening operation safer*, and (4) to give the steel "*red-hardness*," or the ability to do its work when the tool is heated so hot that a plain carbon steel would soften. Alloys may produce many other minor effects, but the four just mentioned constitute the principal reasons for which they are added to the steel. The effect of each element will be briefly discussed.

Carbon. The function of carbon is to make the steel harder and more wear-resisting. Plain carbon tool steels must be quenched rapidly in water or brine in order to harden and therefore they harden on the surface only. If the piece is about ¾" round or larger, it will be hardened only about 3/32" or ⅛" deep and beneath this there will be an unhardened tough core.

The lowest carbon likely to be found in a plain carbon tool steel would be about .50% to .60%, and this steel might be used for such things as blacksmith's tools, hammer dies, and swages. As more carbon is added, the steel's capacity to harden is increased until about .80% carbon is reached, whereupon it will become file-hard when quenched. Adding more carbon than this does not increase the measurable hardness, but it does increase the wear resistance. The highest carbon normally found in a plain carbon tool steel is about 1.30% and this steel is used for razors, engraving tools, and fine cutlery. A good average carbon content for use in the tool room is about 1.05%. This becomes very

FIG. 36.



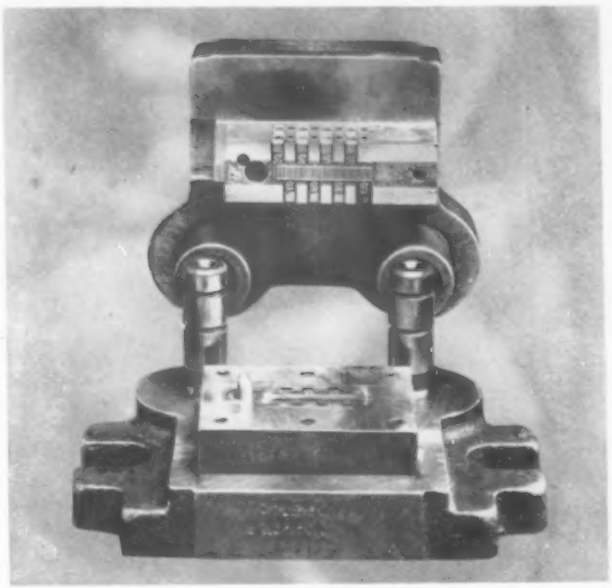


FIG. 37.

hard, has good wear resistance and yet the carbon is not high enough to make it fussy or sensitive to heat treat.

Before the discovery of timbre, practically all troubles with plain carbon tool steel were blamed on the analysis. No inventory was complete that did not contain at least a half dozen different carbon ranges to take care of various types of tools and to be prescribed in case of trouble. If a 1.00% carbon steel were used and the tool broke or chipped, a .90% carbon steel would be recommended. It is now known that most of the troubles were due to timbre, rather than analysis, and today, a good tough timbre steel containing 1.05% carbon is more universally applicable than all the old brittle timbre analyses put together—an important advancement made possible by modern research.

Manganese. Manganese helps to make the steel sound when it is first cast into the ingot. It also makes the steel easier to hot roll or forge. For these reasons, practically all tool steel will contain at least .20% manganese, which can be present up to .50% before it is regarded as a special "alloy" addition.

Hardness Penetration Increased

The effect of adding more manganese to a simple carbon steel is to increase the penetration of hardness. So powerful is its effect that the inclusion of about 1.50% manganese to a steel containing 1.00% carbon would cause it to harden clear through to the center of a 2" cube, whereas without the extra manganese, the same cube would harden only about 3/32" deep on the surface.

Furthermore, the manganese causes the steel to harden so rapidly and so deeply that it can no longer be safely quenched in water but must be quenched in oil. This is one way of making an oil hardening non-deforming tool steel—namely, by adding about 1.60% manganese to a .90% carbon tool steel. A third effect of manganese is to lower slightly the critical point and hence the temperature to which the steel must be heated for hardening.

Silicon. Practically all tool steel contains a small percentage of silicon (usually from .10% to .30%) which is added for much the same reason as small quantities of manganese—namely, to facilitate the casting and hot working of the steel. As an alloy, silicon is almost never used alone—or simply with carbon. Some deep hardening element like manganese, molybdenum, or chromium is usually added along with the silicon.

In combination with such elements, silicon possesses a tremendous power to add strength and toughness to tool

FIG. 38.

steel. It also cooperates somewhat in increasing the hardness penetration. For alloying purposes, silicon may be found between .50% and 2.00% but always in conjunction with something else. A tool steel is more likely to decarburize in both forging and hardening when considerable silicon is present as an alloy.

Phosphorus and Sulphur. These two elements are usually reported in the complete analysis of a tool steel. They are both regarded as harmful impurities and are kept as low as possible. In open hearth tool steel they will be less than .05%. In electric furnace tool steel, they will run under .03%—even in the cheapest grades. In the better grades they are kept below .02% and it is not uncommon to find them below .15%.

In machinery steel, phosphorus and sulphur are sometimes deliberately added to make the steel more free-machining. In these products, however, quality is not of such paramount importance; besides, they do not have to be heat treated in the same sense as a tool steel.

Chromium. Like manganese, chromium causes the hardness to penetrate deeper and, when present in sufficient quantity, will confer oil-hardening properties. It is not as potent as manganese in this respect but, on the other hand, it contributes wear-resistance and toughness to a greater degree. The increase wear resistance is not necessarily accompanied by greater hardness.

The low and medium chromium steels do not hold size as accurately as manganese steels, and those which are water-hardened will frequently change size more than even plain carbon tool steel. Again, chromium raises the temperature necessary for hardening, whereas manganese lowers it.

Chromium will be found in tool steel in all sorts of percentages. Plain carbon-chromium steels may contain from .25% to 1.50% chromium and find their largest use in twist drills, reamers, machine knives and mandrels. Carbon-chromium steels containing about 4% chromium have moderate red hard properties and are used for hot forging dies. A very interesting chromium tool steel is found in the so-called "high carbon high chromium" types. These contain from 1.50% to 2.20% carbon and about 11.00% to 14.00% chromium. Sometimes other alloys are added in small percentages, to impart oil-hardening or air-hardening qualities. The properties of steels so alloyed are so completely changed that they hold their size and shape accurately when hardened.

There is about 4.00% chromium in high speed steel in conjunction with tungsten and vanadium. It is a little difficult to separate the behavior of individual elements when the analysis is as complicated as this, but chromium continues to serve its normal purpose of increasing the hardenability and hardness penetration.

Nickel. Nickel is a rather unusual element to be alloyed in tool steel because it has very little effect on the hardenability of the steel, but it does add to the toughness and wear resistance when used in conjunction with some hardening alloy like chromium. Nickel lowers the hardening temperature somewhat and tends to make the steel oil-hardening rather than water-hardening.

Tungsten. Tungsten is the most dramatic alloy to be found in tool steel. It must be added in fairly large quantities to be effective. Tungsten, to the extent of about 1.50%, when added to a high carbon tool steel, increases somewhat its wear-resistance. If the tungsten is increased to about 4% with about 1.30% carbon, the steel will acquire such wear-resistance upon being hardened as to be quite difficult to grind with an ordinary emery wheel. This is about as much tungsten as is ordinarily used in combination with carbon alone. The carbon tungsten steels have no increased hardness penetration, and will decarburize to a slightly greater extent than plain carbon tool steels—perhaps because their hardening temperature is higher.

Friction Can Soften Tools

When tungsten is added between 12% and 20% in conjunction with chromium, it gives the steel a new property—namely, *red-hardness.* Plain carbon tool steel may become very hard when quenched, but if the tool is put to work under some condition where it becomes quite hot, the heat will draw the temper out of the steel and soften it. For example, cutting tools are heated by the friction of cutting and if attempts are made to cut rapidly with carbon tool steel, the cutting edge will become so hot that it will soften.

A steel containing 18% tungsten and 4% chromium can, however, continue cutting—even after the cutting edge has been heated to a dull red color (about 1000 degrees F.). This is known as ***high speed tool steel*** and is undoubtedly the most important alloy tool steel in existence. High speed tool

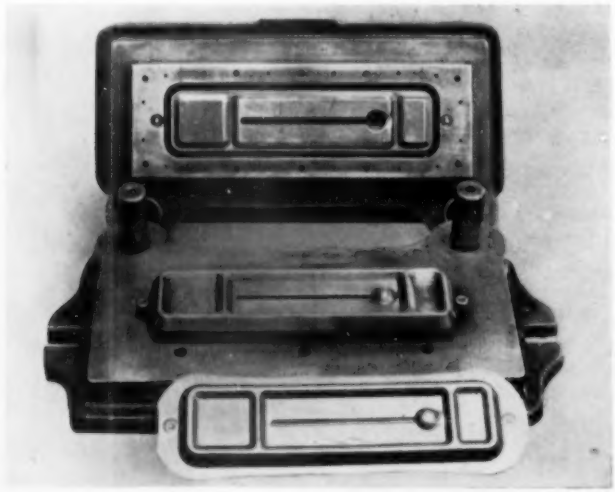
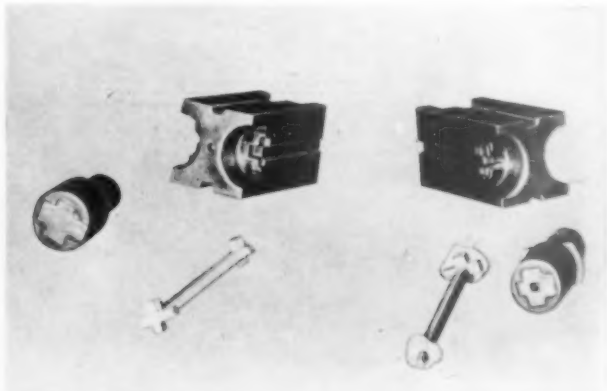


FIG. 39 at left. FIG. 40 below.



el as commonly used today contains about .70% carbon, 5.00% tungsten, 4.00% chromium, and 1.00% vanadium. he vanadium adds further to the red-hardness of the steel.

Vanadium. Vanadium is sometimes added in small quantiies (about .15%) to an otherwise straight carbon steel. In uch quantities, it does not affect the measured hardness or he hardness penetration. In some steels, it imparts a oughening effect by keeping the grain size small, especially hen it might tend to enlarge as a result of overheating. Thus, a vanadium tool steel might be accidentally overheated 00 degrees in hardening without damage. This same effect an now be produced without vanadium by controlling the imbre of the steel. Vanadium also increases the red-hardness of a steel. It is used in quantities between .15% and 1.00% in conjunction with chromium, tungsten, etc., in hot working die steels, and about 1% to 3% of vanadium is put in high speed tool steel for the same purpose.

Molybdenum. Molybdenum shares somewhat the properties of both chromium and tungsten. Like chromium, it increases the hardness penetration and inclines the steel toward oil or air-hardening. Like tungsten, it increases red-hardness and wear-resistance; also, it encourages greater decarburization in forging and heating.

When used between about .25% and 1.50% in conjunction with silicon, manganese, chromium or other elements, molybdenum increases the toughness and strength of tool steel. It is also used to replace varying percentages of tungsten in high speed steel. For example, a very satisfactory high speed steel can be made by using 5% to 10% of molybdenum together with chromium, tungsten, and vanadium.

Cobalt. Cobalt is seldom used in tool steels other than high speed. Here it is added to increase the red hardness so that the tools may be used at higher operating speeds. At the same time, it raises somewhat the temperature necessary for hardening, increases the tendency toward surface decarburization, and decreases the toughness.

Simple Analysis Preferred

It must not be assumed that the effects of the above alloys are all cut and dried, and that the steel maker can always tell in advance what the properties of a new formula will be. This is far from true. The steel maker expects certain tendencies when he adds an alloy—but, he never knows what he has until he tries it out. Two or more alloys in combination will usually behave quite differently from the individual elements if added alone.

And here is a good rule-of-thumb for any tool steel user to remember—"The more different alloys added, and the greater their quantity, the more difficult it becomes to keep the steel uniform and to hold it under accurate control. Other things being equal, the steel having the simplest analysis is the one to be preferred."

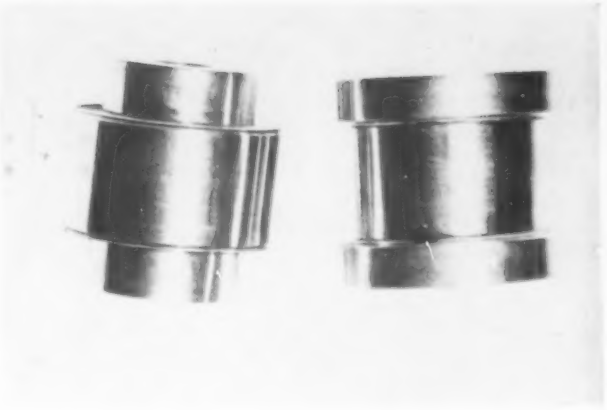


FIG. 41.

Heat Treating Methods

Strictly speaking, all heating and cooling operations constitute heat treatment, whatever their purpose. Sometimes this expression is used in a more restricted sense to mean simply the hardening and tempering treatments.

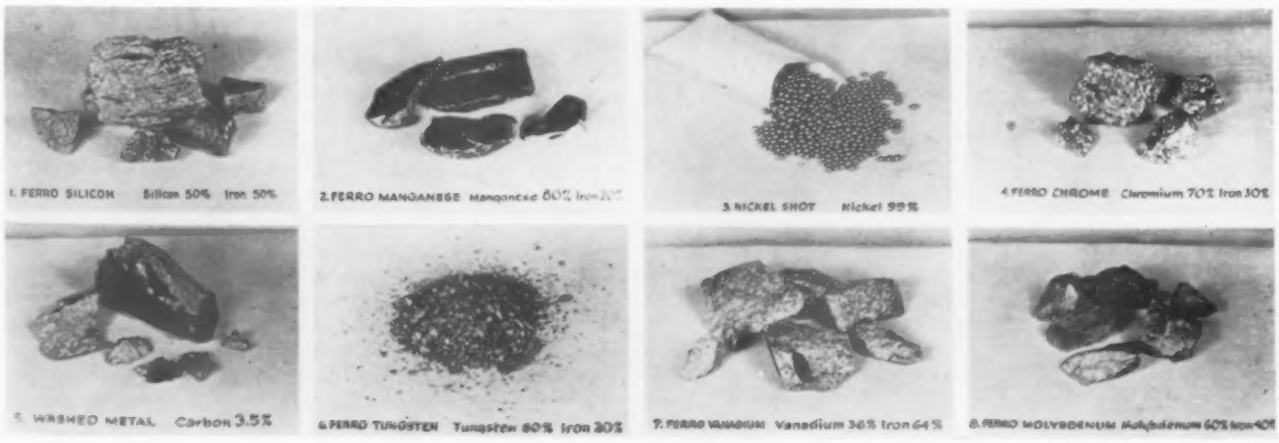
Normalizing and Annealing. Normalizing consists in heating the steel in excess of the usual hardening temperature in order to clear up some undesirable condition in the structure. It is a sort of corrective treatment used after forging, or after an improper job of hardening, in order to put the steel back into a more "normal" condition. In most cases, the steel is cooled in air from the normalizing temperature.

Annealing may be performed for several reasons, only two of which are of interest to the tool maker, that is: (a) *annealing to soften*, and (b) *annealing for strain removal.* A tool steel forging, when hammered, is too hard to machine and must be annealed; or perhaps a tool that has already been hardened must be annealed for some additional machine work.

For this type of anneal (a) it is customary to heat the steel slightly above its critical range and then cool very slowly. The steel maker always furnished annealing temperatures as a part of the instructions for handling his steel. In connection with this subject, it will be interesting for the reader to review the comments on machinability.

As regards annealing for strain removal, no matter how carefully a piece of tool steel may have been annealed in the first place, considerable internal strain can be set up by certain machining operations. It is frequently desirable to get rid of these strains before the tool is hardened. If a large amount of metal is removed by machining, the resulting strains are likely to cause the tool to go out of shape during hardening, even though an oil-hardening, non-deforming tool steel is used.

FIG. 42. Alloying elements as added in the melting of tool steel.



A strain-relieving anneal is conducted by heating the steel to a temperature below the critical point and then cooling. Furnace cooling is best (cooling in lime or dry ashes is fairly good) and even air cooling is much better than no strain-relieving anneal at all. If the steel manufacturer does not publish the temperature for this anneal, the range between 1275 degrees and 1325 degrees F. can be used for almost any tool steel regardless of analysis.

Hardening. Tools are hardened to develop their strength and wear-resistance. The operation consists in heating the steel to some temperature above the critical and then cooling rapidly enough to cause the steel to harden. The hardening temperature is supplied by the steel manufacturer, and this temperature should be adhered to unless the user is willing to do the experimental work necessary to find a temperature that will suit his own particular requirements better.

The quenching medium is also prescribed by the steel manufacturer. Some steels should be quenched in water (or brine); others should be quenched in oil; and a few varieties are hardened by cooling in air. It should be noted here that the steel hardens during quenching in two separate and distinct steps. The second and final step occurs at quite a low temperature during the quench, and it can never be certain that a piece of tool steel has completed its hardening until it is cooled below the boiling point of water or about 200 degrees F.

Instrument Eliminates Guesswork

While it is frequently not advisable to quench a tool absolutely stone cold, it is important that the quench should not be stopped until the tool is cool enough so that it will not boil a drop of water. Remember, too, that large pieces may be much hotter inside than the surface temperature would indicate.

In connection with hardening, a word should be said about special hardening mechanisms. These consist of a furnace for heating the steel and some sort of appliance for automatically telling the operator when the steel goes through its critical point. Some of these appliances show a "hump" on the pyrometer chart; others are actuated by the expansion and contraction of the steel; and still others take advantage of the fact that steel loses its magnetism when heated above the critical point.

It is sometimes recommended that the hardener needs only to heat the steel "safely" above the critical point so indicated, and then quench. There is nothing safe about this procedure. Many alloy steels must be heated 100 degrees F. or more above the critical point in order to get the best results. Some alloy steels require soaking at the hardening heat, and others do not.

These automatic appliances are excellent if the hardener will not attribute to them any more information than they actually give—namely, the location of the critical point. He should depend upon instructions from the steel manufacturer, or from his own experiments, to determine how far above the critical the steel should be heated, and how long it should be soaked.

Pack Hardening. This is a modified hardening procedure frequently recommended for certain types of tool steel. It consists in packing the tools in a container with charcoal, clean cast iron borings, or some other suitable material and then heating the entire pack to the hardening temperature. Obviously, heating progresses more slowly and the time necessary for soaking increases. When the proper time comes, the tool is removed from the pack and quenched.

Aside from the effect of slow heating and long soaking—which are sometimes desirable—this porcedure keeps the surface of the tool free from scale. Charcoal should not be used for pack hardening below 1600° F. because it encourages decarburization. Cast iron borings are desirable at this lower temperature range.

Tempering (or drawing). This operation involves reheating a tool that has been hardened in order to relieve the hardening strain and increase the toughness. Incidentally it usually causes the tool to lose some of its hardness, but this is not the purpose of tempering. The tool maker would rather leave his tools glass hard if he knew they would not break or go out of shape from strain.

The length of time that the tool is soaked at the drawing heat is important. The desired results are really secured by a combination of time and temperature. Almost any tool should be soaked at the drawing heat for one hour. However, large or intricate tools should be drawn longer than one hour. For example, the progressive blanking and stamping tools might well be drawn for two hours if the die were about six inches square, and four or five hours if it were twice as large.

The escutcheon tools, shown in Fig. 39, are about 15" long. If made in one piece, four hours would not be too long to draw them, whereas, made in three sections, one hour would probably be sufficient. Generally speaking, the highly alloyed tool steels should be drawn longer than those containing little or no alloy.

Aging. This is a special operation which is only occasionally encountered. Certain very accurate gauges or tools must be ground and lapped to exact size, and must then hold this size indefinitely. As ordinarily made, a hardened tool may change size or shape to the extent of a few ten thousandths over a period of years. This comes about through a natural aging process. Obviously, tool makers cannot wait for years for a tool to reach stability. Many years of aging can be crowded into a few hours by the following procedure:

After the tool has been properly hardened and thoroughly drawn, it is ground to the point of lapping. It is then heated for an hour or two to the temperature of boiling water and cooled back to room temperature. This is followed by cooling in contact with "dry ice" for a similar time and allowing to warm up to room temperature. It is then put through the same cycle of heating and cooling four or five times more. This brings the steel to a stable condition, after which the final lapping operation is completed.

Basic Fundamentals Considered

In conclusion, there are a few facts relative to the basic fundamentals of tool steels that are worth mentioning. First, good results are obtained when good heat treating equipment is available, for instance, a good furnace with pyrometer control. Second, it is not wise to rush the tools through the heat treating operations, especially during the tempering operation. Third, a good hardness tester should be located in the heat treating department. Fourth, it is good practice to remove at least 1/16" from the tool steel as received, in order to get well under the scale which accumulates in the manufacture of the steel.

Fifth, "beef" the tools up some. When large quantities are necessary, use 1½" thick tool steel for dies or die sections; in other words, it is good practice to use 1" thickness tool steel for dies when blanking up to 1/16" thickness material (1/16" machined from each side = die sections ⅞" thick); 1¼" thickness for dies blanking 1/16" to ⅛" material; 1½" thickness for dies blanking ⅛" to 3/16"; and 1¾" thickness for dies blanking 3/16" to ¼" thickness, or add a ¼" thickness for each 1/16" additional thickness to the blank.

Sixth, when pierced holes fall near the perimeter of the punch (as is the case in compound dies), re-design the die and construct a progressive type die. Seventh, in drawing dies, keep the distance between the draw die edge and the edge of the die as heavy as possible, in most cases a minimum distance of 3", and the heavier the gage, the greater this distance should be, generally. Eighth, it is good practice to put *shear* on all punches and dies that are required to blank 3/32" and thicker material.

By **Arthur P. Schulze**

Abrasive Blast Treatment Speeds Parts Cleaning

Airless Mechanical Cleaning Effects Faster Machining and Improved Quality

THE REMARKABLY RAPID RISE in the use of abrasive-blast cleaning treatments, throughout the metal-working industries generally, constitutes one of the most significant technological trends of the present decade. The time savings, cost economies and processing improvements, effected by this relatively recent technique—especially the airless type—have been proven so substantial in character and extent that, today, abrasive-blasting is receiving growing attention from production men anxious to apply it to their own particular work.

Arthur P. Schulze **was graduated from University of Missouri in 1936. After some sales promotion work for an automotive concern, he became connected with Oakite Products, Inc., then with the Army from 1944 to 1946, served in Public Relations and as staff sergeant in the capacity of Press Chief. He is now Public Relations Director with Taber Instrument Corporation, No. Tonawanda, N. Y.**

With plant performance reports and shop case studies pointedly indicating, in steadily mounting number, that abrasive-blast treatments are blazing the trail to higher standards of mechanical cleaning efficiency and economy, it appears that an editorial examination of this speed-cleaning process would prove of both timely interest and constructive value to many machine shop executives.

The spotlight is focused here, therefore, on a dual objective: (1) a digest-style review of the method's diverse application range, and (2) a comprehensive yet concise resume of the latest blasting equipment developments. Removal of sand, foundry or heat-treating scale from castings, forgings, stampings and other heat-treated parts unquestionably ranks among the more common of abrasive-blasting's many present-day uses.

Spurs Better Machinability

Abrasive-blasting scours out every trace of sand, scale, rust and dirt from the smallest fissure and hair line crack. Because it gets right down to the virgin metal, without the danger of hydrogen embrittlement that so often accompanies the use of acid-pickling procedures, and leaves a beautiful, silvery finish, adding luster and brilliance to any metal it touches, this mechanical cleaning method contributes in no small measure to improved surface condition of work before machining. In a capsule, its effects are: faster machining and grinding, longer tool life, easier inspection, and more accurate hardness readings.

Take, as an example, rough forgings which have been normalized and annealed to relieve stresses and to promote machinability. Naturally, as the slug of steel is heated in furnaces at the forging plant before forming under the hammer, it oxidizes because of the relatively high temperatures needed to condition the steel for hammering. In addition to having this scale formed by metallic oxidation, a large percentage of the surface is burned away by oxygen in the surrounding air.

Forging scale formed under these conditions is usually compound in nature, having a layer of rather tight scale covered by loose or "feather" scale. The "tight" inner scale is formed during hammering; the loose "feather" is formed on cooling after the piece has been forged into shape. After the forging has cooled, it goes to the heat-treater, who takes his turn at adding to or subtracting from the scale. Of course, some of the loose forging scale drops off in the process of handling from one department to another, and more becomes free in the heat-treating furnace. Nevertheless, chances are good that normalizing will replace a substantial portion of the loose scale. That is because atmospheres are not, as a general rule, observed too closely on this rough grade of work.

There are two principal processes for eliminating surface scale before machining operations are started. One is acid-pickling; the other is blasting the work with sand, steel grit, or shot. In commercial practice, acid-descaling procedures are used less and less today because of the inherent danger of pitting the work so deeply that it cannot be cleaned up, the general messiness of the operation, and various other reasons.

With airless-type blast-treatments, on the other hand, removal of heat-treating scale becomes a relatively simple matter because the hard-hitting abrasive-saturated stream quickly breaks up and removes the baked-on scale right down to the bare metal surface. Thus, every nook and cranny is completely scoured until every last vestige of scale is removed. That improved machinability and longer

FIG. 1. Wheelabrator Tumblast, as installed at a mid-western pneumatic tool manufacturing plant. Dustube Dust Collector installed along side of blast-cleaning unit to ventilate the machine. Typical load of tool parts is shown in the apron conveyor of the equipment. Photos by courtesy of American Foundry Equipment Co., Mishawaka, Ind.

tool life go hand in hand with scale-free surfaces is shown by the experience of one plant which, recently, installed an airless-type blast-cleaning unit. A 17/64" drill now runs a full day without sharpening, whereas it formerly required sharpening from eight to ten times a day. This is not an isolated instance but an experience commonly reported.

Equally important, the method is comparably effective in removing scale from machined parts before grinding, coloring, or polishing. Here, for example, are a few typical performance reports: A table of heat-treated gears is cleaned every 10 seconds at a large mid-western truck parts factory. Tractor bull gears weighing 70 to 80 pounds each—a total of 8,000 pounds—are cleaned in one hour at an agricultural equipment plant. Cylinder gears, connecting rods and similar parts are blast-cleaned so fast, in a Michigan plant, that cleaning time has been slashed from three full shifts to only eight hours daily. And, at a southern textile machinery manufacturing plant, 22 tons of gray iron treadle bars, gear blanks and loom pieces are cleaned in less than five hours.

Expedites Grinding and Polishing

Sand and scale removal prior to machining, grinding, coloring, and polishing forms only one of the rapidly growing uses for abrasive-blasting. Another is deburring machined parts. However, one point should be made perfectly clear on this score. While it is true that blast-cleaning will remove certain burrs from machining operations, deburring cannot be performed on a universally effective, satisfactory basis by the equipment employed. Yet, production experience of some machine shops and departments clearly shows that, on some classes of burr-removal work, the method has demonstrated decided time-saving and cost-cutting features.

For example, one particular plant found its deburring problem of such magnitude that the entire production schedule was thrown off balance. Someone then suggested that the burrs might possibly be removed faster and easier by blasting the pieces with a fine metallic grit in an airless-type machine which was being used with marked success on a different job in another department. A test produced surprising results. Production executives were "pleased as punch" to find that the machine turned in a grand job, a short blasting completely removing the troublesome burrs without injuring the part itself.

Another manufacturer, faced with an equally difficult deburring task, had booked a large order for small steel shafts from a customer who demanded a perfectly clean finish. Trouble developed because a long burr remained in the cut after notching one end of the shaft. Experiments with various abrasives soon revealed that a small airless-type blasting unit would remove the burrs perfectly. Accordingly, it was promptly installed and, in a short time, the savings effected on this one job alone repaid the investment in the equipment. Currently utilized for handling other cleaning operations in this plant, it is providing still further economies from both processing time and unit cost standpoints.

In still another plant, burrs were forming on the end of coiled springs during the grinding operation, because the heat generated was sufficient to weld some of the fine steel particles that were ground off. A few minutes in an airless blasting device completely removed the trouble-causing burrs and convinced the worried production superintendent that here was an effective means for handling his particular burr-removal job quickly and inexpensively.

Prepares Metals for Final Finishing

Surface preparation of work for final finishing—such as electroplating, galvanizing, organic finishing, Sherardizing, Iriditing, black oxide coating, metallizing, rubberizing—comprises a third highly important application of abrasive blast-cleaning today. In fact, many authorities advise the use of grit-blasting as a surface preparation process before the product-finishing operation because it tends to promote a better bond for the subsequently applied coating. The force and sharp points of the grit "break up" the smooth surface, slightly "roughening" it to assure the uniformly tenacious adhesion so necessary for a durable finish to satisfactorily meet stringent service standards.

Of further interest, in connection with these final finishing applications, is the fact of sizable time savings and other plus-value benefits effected by speed-cleaning parts the airless-blasting way. Take, for instance, the case of a large mid-western manufacturer of pneumatic tools and related equipment. Shortly after an airless unit was installed in his cleaning department, inspection of blast-cleaned pieces revealed a surface appearance far superior to that formerly obtained by polishing.

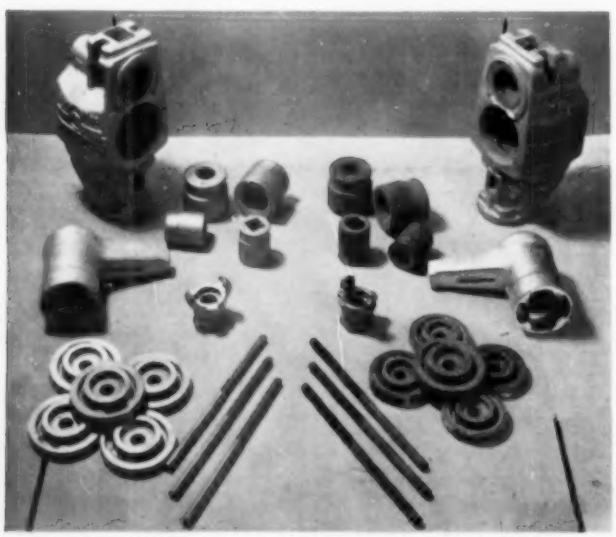
Aluminum drill handle castings, shown in the apron conveyor of the equipment illustrated in Fig. 1, formerly required a three-minute polishing operation, per piece, to prepare them for painting. Now, a load of these castings is thoroughly cleaned in the machine pictured in two to three minutes. No further "conditioning" is needed to give the surface a perfect bond for subsequent painting.

Not only is the appearance of the finished pieces vastly improved. More important, precious minutes are saved on every cleaning job. As typical examples, 30" long air hammer tools, 30 to a load and mixed with wrench sockets to complete a load, are cleaned in five minutes. Formerly, it took four minutes to clean each tool with airblast equipment. Six hundred small bronze castings, each about 3" in diameter, are cleaned in five minutes. In a small suction-type blast cabinet for processing, this same quantity of work would have taken eight hours' time.

Fig. 2 includes a number of castings speed-cleaned in airless equipment. Thoroughness and uniformity of cleaning obtained are plainly marked in this "before-and-after" illustration. Encrusted deposits have been completely stripped from the work, signalizing a degree of efficiency unobtainable with airblast and tumbling procedures previously practiced in this particular instance.

Other widespread applications of blast treatments today include preparation of work for inspection, such as blasting of heat-treated parts to reveal soft surface spots, or to prepare pieces for Magnafluxing; peening, to relieve surface tension in parts by pre-stressing surfaces to increase fatigue strength and life of pieces cold-worked in this manner; and

FIG. 2. **Before and after Wheelabrating. Included in this photograph are a number of aluminum and grey iron castings made by leading manufacturer of pneumatic tools. The pieces at the left have been blast-cleaned in a Wheelabrator Tumblast and the pieces at the right are covered with scale and sand awaiting cleaning. Only a few minutes' exposure to the abrasive blast stream removes all foreign material from the castings.**



rrection of surface defects. Many parts, which Magnaflux other close-limit test methods reveal as having surface fects, are being successfully peened and salvaged.

In some plants, it is becoming increasingly common for mbinations of all these operations (except peening) in one rm or another to be performed simultaneously in single sses of the work through the abrasive blast stream. Clean- g heat-treated parts and inspecting them for soft spots fords one example. Shot-peening steel while giving it a ecial mechanical finish is another, and cleaning and surface- reparation prior to electroplating comprises still another.

Equipment Engineering Reflects Rapid Progress

The growing popularity of the abrasive-blasting technique, accentuated throughout the critical war period when peak production was industry's "order of the day," is due mainly to the giant strides made in equipment engineering, design and operation. A notable contribution, along these lines, is the relatively recent development and refinement of the "Wheelabrator," by the American Wheelabrator & Equipment Corporation of Mishawaka, Indiana, formerly known as the American Foundry Equipment Company.

Incorporating a rapidly-rotating bladed wheel of special design, this unique device normally throws from 300 to 900 pounds of steel abrasive per minute on the work to be cleaned, depending upon the size, shape and condition of parts. It provides a key to effective cleaning by making possible complete utilization of the abrasive blast. In this bladed wheel, there is no waste abrasive since the blast stream is accurately aimed by scientific directional control with the desired intensity and volume. Through a simple adjustment of a control cage, the abrasive blast may be directed to any position so that the unit's optimum efficiency is realized.

Available in a wide range of sizes to meet the demands of virtually any application, depending upon the specific purpose for which it is intended, the Wheelabrator comes as standard equipment on many blast machines based in operational principle on a dual "tumbling-blasting" motion so extensively employed in numerous current blast-treatment installations.

Cleaning Varied Compact, Rugged Parts

One representative unit of this category is the "Wheelabrator Tumblast," which is widely used in cleaning compact pieces of sufficient ruggedness to withstand a gentle tumbling action. Made in different sizes for blast-cleaning work loads in which individual items vary from a fraction of an ounce up to 1,000 pounds, it employs the endless conveyor principle of tumbling, fully exposing all surfaces of every piece to the scouring action of the intensive abrasive bombardment.

Economies of the machine have been extended to handling flat or fragile work not suitable for tumbling, by the second class of machine—the table type—which is furnished with a single table, or a number of independent work tables, depending upon the type and size of the work to be cleaned. The plain table is recommended for work that does not have too many pockets or vertical edges, while the "Multi-Table" units are designed for handling pieces with intricate cavities, deep pockets and crevices, or high vertical edges.

Handling Large, Intricate Work

The "Swing Table" is designed for plants requiring moderately priced equipment capable of handling a wide range of work, where daily production volume is insufficient to warrant the installation of several different types of cleaning equipment. This is a versatile, general-purpose blast-cleaning machine which, thanks to its speed and economy, proves ideal for cleaning large, intricate pieces that normally would have to be laboriously blasted in an airblast room. Four sizes are available with single work tables of 24", 66", 72" and 86" in diameter. Operation of the four units is essentially the same in each instance as the machines vary only in minor construction details and in the number of units utilized.

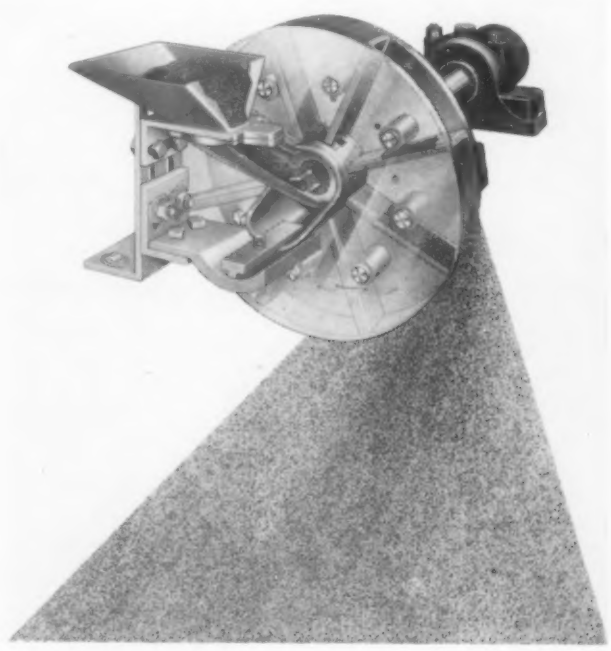
The economies made possible by this latest production-cleaning development are aptly illustrated by the following examples: In one mid-western plant, practically the entire output of furnace castings is cleaned in this unit. Where three castings formerly required four hours to clean by tumbling, they are now cleaned in only two minutes per side. In another plant, this machine eliminated considerable hand cleaning in the airblast room and replaced a large tumbling mill which had been operated 24 hours a day to turn out the scheduled volume of work. Cleaning time has been reduced to eight minutes per table load (both sides) and cleaning costs have been cut 25 per cent.

With the installation of a Swing Table at an Ohio plant, cleaning costs have been reduced by approximately 40 per cent. This unit is handling castings which cannot be cleaned in another machine and, in addition, is being used for cleaning steel pipes, welded sections and miscellaneous work from other shop divisions. Maximum weight of the work is 1,800 pounds and many of the pieces overhang the edge of the table. Cleaning time varies from 6 to about 12 minutes, depending altogether upon the design and type of work being processed.

Where special production conditions prevail, or where parts are of a size, shape or weight to make them unadaptable for cleaning in one of the standard machines, special cabinets are employed. Engineered expressly to meet individual blast-cleaning or mechanical finishing requirements, these units incorporate work-handling methods best suited to present the pieces to the one or more Wheelabrators used. Certain types of work are given a rolling, tipping or spinning motion throughout the blasting cycle.

All of these machines are completely airless. By utilizing

FIG. 3. Phantom view of the Wheelabrator, an airless-type mechanical method of cleaning and finishing metals by abrasive blasting. In the Wheelabrator process, abrasive from an overhead storage hopper is fed to the center of the wheel which rotating at high speed, throws the abrasive against the work by centrifugal force. A cast-alloy impeller rotates with the wheel proper and carries the abrasive to an opening in the stationary control cage, where it discharges to the bladed section of the wheel. At this point, the abrasive is picked up by the inner ends of the throwing blades and is gradually accelerated in its passage to the periphery of the wheel. The final throwing velocity is the resultant of radial and tangential forces, hence, the blast utilizes all of the power supplied.



controlled centrifugal force instead of compressed air for abrasive blasting, they eliminate costly air pressure equipment and also accomplish sizable savings in the horsepower required for generating air pressure. The method thus eliminates the high costs entailed with compressor operation, lubrication and maintenance.

Of the several factors governing cleaning efficiency obtainable with the airless abrasive-blasting process, proper installation and maintenance of an adequate ventilating and dust-collecting system constitute the most essential. If dust is not properly controlled it will escape into the room, making working conditions hazardous and causing wear in blasting equipment and other machinery.

Good Housekeeping an Essential

It is important, as well, that all sand, scale and useless fine particles be removed from broken-down abrasive. Fine dust and sand retard the cleaning action, smudge the work, lengthen cleaning time by as much as 50 per cent, and increase the rate of wear on blades and other wearable parts of the blasting unit. A ventilating and dust-collecting system of adequate capacity and correct design will maintain cleaning effectiveness at a high point over long periods of time, provided the system is inspected regularly to make certain that it is functioning as the manufacturer recommends. Some of the often-overlooked points which this periodic checkup includes are:

1. Keep dust collector from becoming overloaded. Shake tubes when needed; empty hoppers daily. 2. Check condition of dust collector tubes to make sure they are not torn nor damaged. 3. Check vent piping to make certain that dust deposits have not accumulated through a drop in air velocity. 4. Check suction fan belt to make certain there is no slippage. Be sure to operate fan at proper speed and in right direction. 5. Check abrasive separator once daily. Adjust discharge orifice to provide as even a flow of dirty abrasive over the shed plate as possible. No foreign material should be imprisoned in the slot. Also check orifice to make sure that wires or refuse are not impeding abrasive flow through separator.

6. Make certain that all cover plates and inspection doors are in place, especially those on the abrasive separator, elevator head, and on dust collector. Otherwise, air by-passes through these openings, seriously affecting efficiency of dust-collecting equipment. 7. Use proper type and size grit as recommended by the equipment manufacturer. In cleaning work before grinding, for example, a medium-size grit or shot is usually advised since it leaves the surface bright and smooth, keeping the grinding wheels from loading up with scale and dirt. Remember, too, in this particular connection that a far greater portion of work can be ground when a clean, scale-free surface is employed.

Method Merits Further Study

The full story of airless blast-cleaning—its contributions to speedier production, greater output, lower costs and better cleaning—would take considerable space, especially so since importance of the objectives has not diminished with the restoration of a peacetime economy. So, with industry striving to attain these goals, it is hoped that, while necessarily incomplete, the foregoing discussion of this fast-growing technique, which highlights its principal advantages and the latest types of equipment available, provides some "food for thought" for those production men "on the alert" to new, improved ways of turning out many old cleaning jobs faster, easier, and at less cost.

Versatile Milling Attachment Speeds Rush Job

A TYPICAL EXAMPLE of the savings in time and costs to be effected with modern machine tools and attachments is indicated by the following account of a rush job at the Federal Tool Company, Johnston, R. I. The job in question consisted of nineteen jigs for the cutting of knife blades, and the time involved quite precluded scribing out the necessary slots and the angled drilling points on each jig.

Thomas Tabellario, old timer shop foreman with plenty of "know-how," took over the job personally and, inside of two hours, all jigs were on their way to the customer. The estimated saving in time alone was around seven hours. All operations were done on a Fray 7-BH milling machine on which was mounted a Fray "All Angle" attachment which was displayed in the Tools of Today department, March '47 *The Tool Engineer*.

The miller and attachment, which are distributed by the Leach Machine Tool Company, Providence, R. I., are each extremely versatile and embody features that make them applicable to a wide variety of intricate milling jobs. As shown in the larger photo, for example, the jigs described above are being spot drilled with the attachment in vertical position; then — as shown in the smaller photo — the head is angled over for the angular drilling. Thus, whether milling or drilling, a job can be processed without disturbing the original setup of the workpiece.

By **Thomas A. Dickinson**

Modern Sand Casting

Marked economies effected through advanced foundry practice and low cost materials

DESPITE ALL THE PRAISE that has been bestowed on built-up tool structures and inexpensive plastic castings, there is no economical substitute for the sand-cast metal tool when the combination of high metallic strength, homogeneity, and complex design is desirable.

Many tool engineers have been inclined to overlook the simple technique of sand casting in recent years, because of the old belief that sand casts are inherently weak and undependable structures. However, with modern methods of fabrication and inspection, it has been proved many times that sand casts can be as good as built-up metal structures and machined dies for most practical purposes—although they frequently cost almost as little as some of the lower-strength plastic tools which are now so popular.

Therefore, the purpose of this article is to review the sand-casting process, emphasizing the recent innovations that help overcome the old objections to sand casts, in view of the author's experience on the West Coast. If this experience should seem limited, the reader will do well to recall that tooling as well as sand-casting generally is a small-scale production project and that small-scale production has long been receiving more attention in the West than in the East.

Like all casting procedures, sand-casting necessitates the use of a pattern or master and is most advantageous when a single unit must be reproduced several times. However, it is often cheaper to sand-cast only one article than to undertake a complex machining job because sand molds can be quickly fabricated from low-cost patterns. When as many as a hundred duplicates are required, permanent molds may or may not be as desirable as sand molds—depending on the design of the article and the cost of the permanent mold it will require.

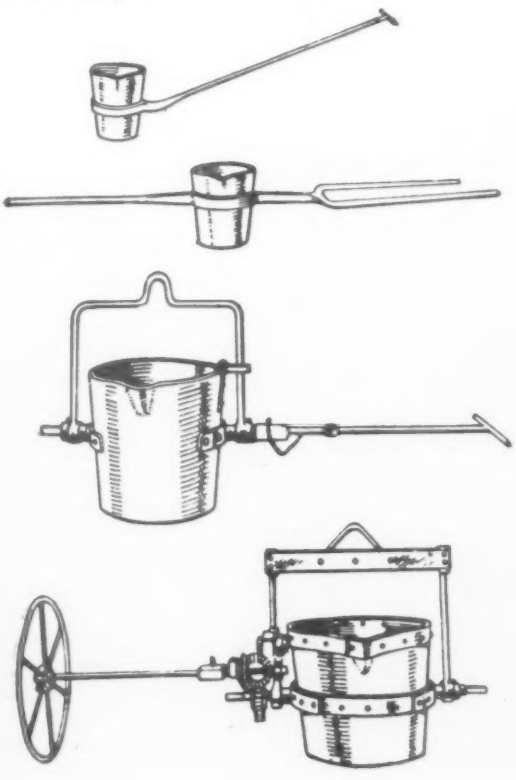
Among the low-cost materials that have been used in making sand-mold patterns are modeling clay, plaster, wood, and plastics. Probably the best of these for general purposes is the thermoplastic Plasticarve, whose development was discussed in a recent issue of *The Tool Engineer*.

If the pattern is handled with reasonable care, there is little danger of breakage even when press forming is necessary since it is normally padded on both sides with sand during the essential mold-fabrication process. However, if it should be damaged after only one mold has been made, it can be replaced with a stronger metal cast.

When dimensionally-accurate casts are required, the pattern may be made oversize to allow for metal shrinkage. If shrinkage data for a specified alloy are unavailable, shrinkage may be computed as follows: Cast iron, 3/32 to 1/8 inch per foot; common brass, 3/16 to 1/8 inch per foot; yellow brass, 7/32 inch per foot; bronze, 5/32 inch per foot; aluminum, 7/32 to 1/4 inch per foot; steel, 3/16 inch per foot.

Good mold-making sand has six essential qualifications—porosity, plasticity, adhesiveness, cohesiveness, refractoriness, and strength when heated. It must be porous enough to permit the escape of air, gases, or moisture that may be present or generated in a mold during the metal-pouring

Shown here are some of the pouring ladles used in foundries for various types of sand castings.



A ladle full of hot aluminum is weighed by a Northrop Foundry worker to make sure that the contents will be sufficient to fill a sand mold at one pouring.

Talcum is dusted onto a flask-enclosed pattern for a sand mold. Dusting prevents the eventual adherence of sand particles to the pattern surfaces.

procedure. Its plasticity should be such that it can be formed on or in a pattern without excessive roughness or flaws.

It should be adhesive enough to cling to the sides of the box or flask in which it is molded, or to any supports that may be used in its fabrication. Its particles should have cohesiveness enough to stick together, forming smooth casting surfaces after a pattern is extracted from a mold, and those particles must be refractory enough to resist fusion of the type that would alter their arrangement when they are in contact with a molten metal.

In small shops, where only a few sand molds are required, it is generally a good idea to purchase ready-mixed molding sand from commercial foundries. But, when extensive production requirements prevail, most factories will find it economical to purchase sand-mixing machines.

It is necessary to mix molding sand because no one type of natural sand has the required properties, and experts generally agree that best results can be attained by combining sharp-grained river sands and round-grained lake sands so as to produce a final mixture with about 85 per cent silica, 8 per cent alumina or clay, and 7 per cent magnesia or other ingredients. All particles should be screened for the mixture, and the most homogenous results can be achieved with centrifugal mixing action.

The two general types of sand molds are:

(1) *Green-sand molds*—distinguished by the fact that they are not thoroughly dried before use.

(2) *Dry-sand molds*—distinguished by the fact that they are dehydrated in an oven before use.

The latter type generally gives best results, because it presents no danger of moisture contamination and facilitates the escape of gases. However, green-sand molds are often used because they can be made with comparative speed and "faced" so as to eliminate most objectionable features without difficulty.

Coal, charcoal, coke, or anthracite powder may be mixed into the sand before a mold is made to facilitate the escape of hot air during the metal-pouring procedure that will ensue. Not more than ten parts of carbon powder should be used with each hundred parts of sand, because larger quantities of powder might impair the cohesiveness or strength of the mold. Thorough mixing of the molding sand and carbon powder may be satisfactorily accomplished in any large, flat tray that is reasonably clean.

If the pattern has anything other than a very simple and symmetrical shape, the mold must be made in two or more parts so that it will not be damaged when the pattern is removed. These parts are usually made in a sectioned flask or mold box. Exact design and dimensions of the box depend on the ingenuity of the tool designer, but it should usually comprise a wood or metal frame whose cope and drag will fit together accurately with suitable pins so that there will be no danger of misalignment. If lifting will be necessary, appropriate handles should be installed on the flask.

The pattern should be dusted on both sides with talcum before it is used to make a mold, because molding-sand particles will tend to adhere to even the smoothest pattern surfaces when no "parting agent" is utilized. When the pattern has been positioned in the flask, sand should be screened so as to form a layer that will be both fine and thin over each of its faces in order to minimize the sort of cavity-defects that will eventually cause rejections. It is not necessary to screen thick layers of sand onto the pattern, as a rule, since lumps can cause little trouble in the mold body.

Presses May Be Used

Most foundries make use of presses to squeeze molding-sand particles to a suitable state of cohesive density on a flask-enclosed pattern, but most strong workmen can achieve equally good results by pounding the sand particles into position with manual rams. If the sand particles are not rammed together with considerable force, the mold may not retain its shape after its pattern is removed. However, this should present few difficulties in view of the previously-explained padded condition of the pattern.

After the ramming or press-forming operation is complete, it is usually a good idea to ventilate the sand mold before its pattern is extracted. This is ordinarily accomplished by inserting stiff sections of wire to predetermined depths in the mold back. The wire should have a diameter of about 3/16 inch and should extend downward into the mold to a distance of about ⅛ inch from the upper mold face. Vent holes facilitate the escape of gases and steam, and should never be closer than one inch to the edges of the flask or to one another.

It may be further desirable to place the mold in an oven for drying before the pattern is extracted. However, this

A Northrup foundry worker lifts a pattern from the drag section of a sand mold. In this case, the mold will be used to make heat-vulcanization forms for rubber products.

depends on the nature of the pattern and should be attempted only after tests have been made with appropriate moisture-control apparatus. If the sides of the flask are tapped gently with a hammer before the flask parts are separated, a pattern can usually be removed from a sand mold without preliminary dehydration. However, great care should be invariably exercised in separating the flask parts and lifting the pattern.

Runner and riser channels are cut in the cope section of an open sand mold in the same general manner that an apple is cored—by pushing thin sections of pipe through the sand where there is the least likelihood of weakening the mold. Sand can be removed from the pipes with a round stick, and horizontal channels or "gates" should be cut and faced as necessary to connect the pipes with the mold cavity. Because the gates will produce projections on finished casts, each mold cavity should be "fed" so that its "gate sprues" can be removed by cutting or machining with least difficulty.

When the runner-riser channels and their gates have been suitably cut, dehydration and "facing" may be accomplished. As previously intimated, it is not always necessary to face dry molds or molds that are to be dried before use. However, it is often desirable—and never dangerous—to face either type of mold cavity. Graphite is probably the most refractory of mold facing materials, and it may be applied either by dusting or mixing with a vehicle such as shellac and brush-coating.

Drying with Infra-red Lights

In several West Coast foundries, it has been found possible to dehydrate sand molds and harden various liquid facing mixtures simultaneously with infra-red lighting.

Pouring "cups" should be situated on the runner and riser channels of the cope after the flask parts have been reunited, so that the empty mold cavity can be filled from two directions if necessary. As a rule, these cups should be made by ramming sand into a small wooden form, hollowing to a desired funnel-shape, and facing in the same manner that the mold cavity is faced. Metal cups are rarely desirable because they are too likely to cause premature chilling of the cast metal.

When sand molds are not to be used as soon as they are fabricated, provisions should be made to cover the pouring cups so as to keep dirt and other foreign matter from the channels, gates, and mold cavity. Cores for hollow casts may be either an integral part of the mold drag or separate installations, depending on the design for the finished cast. If the core is an integral part of the mold, it should usually be situated in the drag because there it is least likely to be damaged during the process of extracting a pattern.

Molten metal is poured into an open-topped sand mold at Consolidated Vultee. Molds of this type require no ventilation and will produce casts of maximum accuracy.

Sand is shovelled onto a flask-enclosed plaster pattern to make a mold for casting metals at Consolidated Vultee.

Separate cores are usually cast from molding sand in wood or metal "core boxes." Such core boxes are simply molds with cavities of the required core shapes, and each should be carefully coated with lacquer and wax to prevent the adherence of cast particles in the cavity.

The sand used in making separate cores can be cast and hardened to withstand considerable handling if it is moistened with equal parts of water and syrup before it is rammed into a core box. When it is desirable to ventilate a separate core, waxed strings should be positioned in the core box prior to filling with sand so that they can be easily removed after the core has been hardened with heat and the wax has been dissipated by melting. Wire and other reinforcements can be used to stiffen sand cores that are slender and too likely to be damaged before use.

In making some of the more simple types of casts, it is often possible to avoid mold-fabrication difficulties by using single-unit or open-end molds which require no ventilation. Also, the cavity of piece molds can sometimes be fed directly by pouring channels or gates. Besides requiring no ventilation, these mold designs make it possible to minimize shrinkage by slow-pouring and agitation of cast metals with a "feeder rod."

Grey-iron "chills" should be used in a sand-mold cavity whenever extremely hard and durable wearing surfaces are essential. The depth of hardness caused by a chill is proportional to the thickness of the insert, one-inch thickness being usually sufficient for skin or surface hardening. The exposed surface of a chill should be even, but not too smooth or polished, and coated with black lead to prevent adherence to a cast.

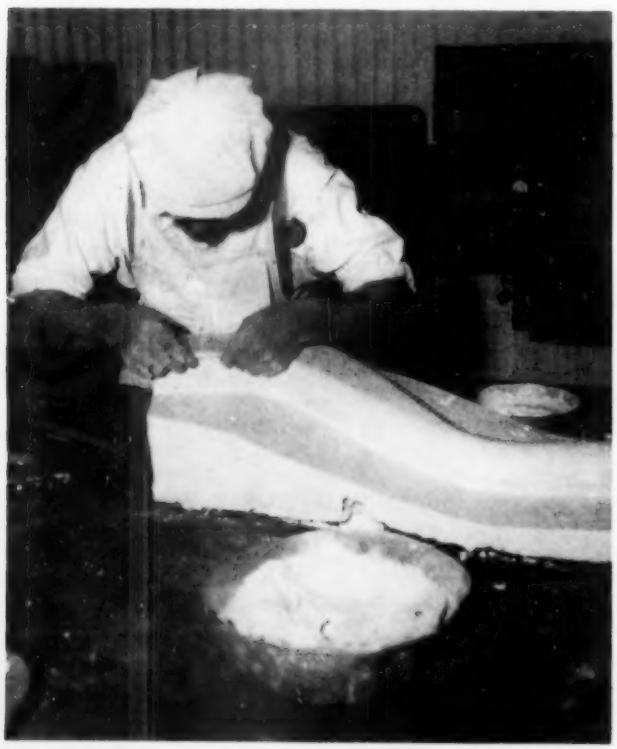
It is never desirable to make sand molds with more than two parts, and when the design of a pattern is such that it could not be extracted from a two-part mold without causing damage tool designers will ordinarily find it possible to avoid fabrication difficulties by calling for "loose-piece" patterns. A loose-piece pattern is nothing more than a pattern assembly whose units can be detached and removed separately from a mold cavity.

Foundry workers at Consolidated Vultee Aircraft Corp'n, San Diego, Calif., transfer molten aluminum from a huge melting pot to a pre-heated ladle which is suspended from an overhead crane. The crane will convey the ladle to a sand mold when this operation is complete.

Because it is generally impossible to make more than one cast in one sand mold, considerable time can be saved in casting small articles by using several identical patterns and fabricating multi-cavity sand molds. When this is done, it is usually desirable to connect all cavities with gates so that necessary pouring can be accomplished through a single runner channel.

It is not unusual for a sand mold to be damaged slightly during the pattern-removal procedure. However, if the tool engineer has exercised sufficient foresight, such damage should be reparable by filling-in or cutting-away defects. In making or approving a sand-cast design, the tool engineer should further bear in mind the fact that a finished cast will almost invariably require some machining in order to remove pouring sprues or gate-marks and that the difficulty of such machining will depend on the locations of the projections.

A Consolidated Vultee patternmaker finishes an air duct pattern which will be used to make a sand mold for casting a metal aircraft part.



A sand-cast form block is polished and made ready for presswork at Consolidated Vultee.

Brass and aluminum alloys are probably the best sand-casting metals now available. Both types of metals can be melted and poured with comparative ease, and their selection for any given job should depend upon the weight-strength ratio that is desired. Aluminum casts are almost invariably preferable in casting tools that must be handled extensively, but cannot compare with brass casts where high strength and weight are the most essential requirements.

Melting pots and pouring ladles for sand casting are fairly inexpensive, and there should be no hesitancy on the part of any concern to obtain such equipment in adequate quantities because it is generally impossible to make good casts when each sand mold cannot be filled with one pouring.

The dependability of a sand cast is proportional to the dependability of the method by which it is inspected, and all authorities agree that there is no substitute for the X-ray method of examining metal articles when rigid specifications

An inspector checks the X-ray transparencies of two sand casts. It has been established that sand casts can be as dependable, for most practical purposes, as other types of metal articles provided that they are carefully inspected by methods such as this before they are used.

must prevail. However, this should not necessitate high investments in X-ray equipment for small concerns that require quality work, since arrangements can usually be made for low-cost inspections at shops which specialize in X-ray work. The dependability of properly-inspected sand casts is proved by the fact that, during the war, government inspection authorities revised numerous specifications to permit the use of sand casts as highly-stressed structural parts.

Great Savings a Result

Insofar as the tool engineer is concerned, sand casting is a particularly economical method of fabricating molds and dies of the types used in making rubber and plastic products. This is especially true of the plastics industry, because the recent development of low-pressure resins has obviated the need for many of the expensive machined molds which have previously relegated many plastic processes to mass production alone.

For example, at Industrial Plastics Corporation of Gardena, Calif., it has been found possible to compression-mold glass fiber plastics with sand-cast molds that cost less than $100 each—resulting in articles whose molds would have cost at least $2000 each a few months ago.

Probably the largest and best-equipped foundry on the West Coast today is Northrop Foundry, a Los Angeles subsidiary of Northrop Aircraft Company. Some ideas of the possibilities of the sand-casting technique may be gleaned from the fact that this company has, since the war, found it practical to sand-cast the following commercial items with aluminum:

(1) Heavy-duty engine parts for gasoline and jet-propulsion power plants; (2) molds for plastic luggage; (3) high-strength wheels for conveyor units, lift trucks and materials handling equipment; (4) vulcanization forms for rubber products; (5) household utensils; (6) experimental and production novelties; and (7) form blocks for sheet metal presswork.

By Vaners Borg

"News" in The Plastics World

Presenting Tools of Today that Cut Costs in Plastics Manufacture

ONE OF THE BIG PRODUCTION stories of the year, and of particular and timely interest to manufacturers engaged in plastic molding, is the announcement of what is said to be the first fully automatic molding machine for thermosetting plastics. Called the Rockford Hy-Jector and a product of the Rockford Machine Tool Company, Rockford, Ill., this machine now combines, in one unit, the conventional and comparatively slower three-stage production sequence usually carried out on separate machines.

In the Rockford machine, the basic steps of making the preform, preheating, molding and curing are all carried out automatically and in uninterrupted sequence. As a result, there is obtained high output with accurate, automatic time control for each stage in the cycle. Variables ordinarily created by manual interruptions are eliminated by the use of interlocked electronic controls and timers, infinitely adjustable to meet every requirement.

The seven steps in the complete machine cycle are schematically shown in Figs. 2 to 5. Once the machine is set up, with controls set as required, operation is entirely automatic from the feeding of the plastic powder to removal of the finished part from the mold. The photographs—Figs. 1 and 2 to 5—show the Hy-Jector, the preform in preheat position in the dielectric heating chamber and the removal

FIG. 1. **The Rockford Hy-Jector Molding Machine for Thermosetting Plastics. With this machine, dimensional stability is inherent and the accuracy of the finished part is equal to the accuracy of the die. Split second timing controls all operations.**

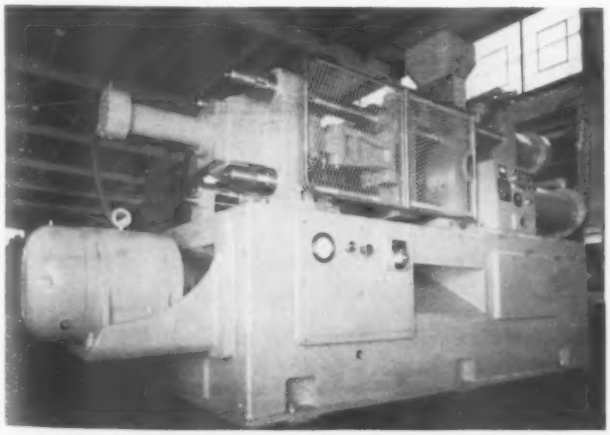


FIG. 2, **left, shows how material feeds by gravity from hopper into measuring chamber, which is infinitely adjustable up to 8 oz. maximum. This assures automatic selection of exact amount of material, as set, and eliminates waste and contamination. At right, the forward travel of the measuring chamber piston, in the cylinder, blocks off feed from the hopper and carries the material to throat of preform cylinder. Material feeds by gravity.**

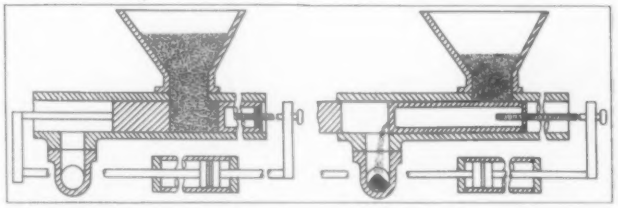


FIG. 3, **left. The preform cylinder and mechanism—an integral part of the Rockford Hy-Jector. Actual position of the preform cylinder is beneath and at right angles to the measuring cylinder. At right; when material is received into the preform cylinder, its plunger moves forward, compressing the material into a preform. Correct pressure—achieved through adjustable controls—is automatic for any size preform and assures correct preform density.**

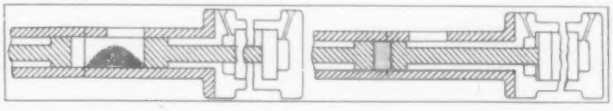
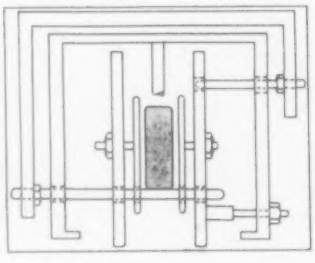


FIG. 4. **The preform is next carried automatically into the dielectric heating chamber, where it is heated to an exact degree of temperature for a specific period of time as set by the automatic controls. Controls in setup are quickly and infinitely adjustable to minutely accurate divisions of time and temperature.**



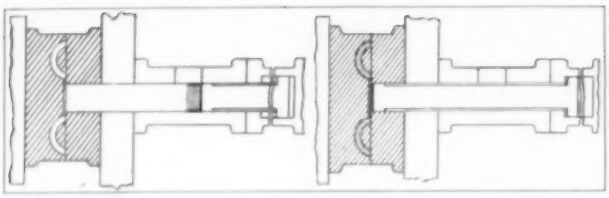


FIG. 5, left. As the preform is moved from the dielectric heating chamber into the molding cylinder, the charging ram rapidly advances, forcing the preform into the die. The heated dies are in closed position, held by a power-locking and clamping mechanism. At right, the material is shown being forced into all cavities through gates in the die. Polymerizing takes place, under automatic control, for the period of time established, when the dies open and the finished part is ejected.

of a molded part from opened die at the end of the cycle, in the order listed. The various operation sequences are explained in the captions.

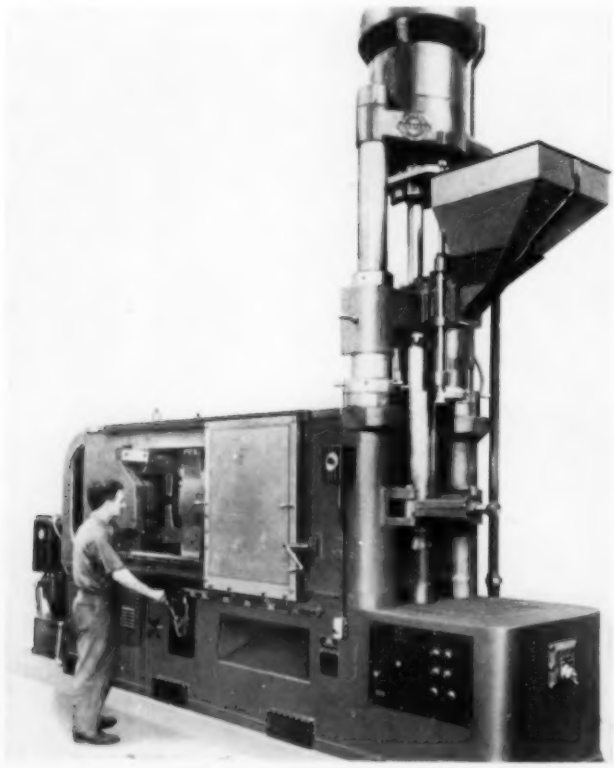
In addition to production speed, many important advantages are claimed for the machine. Finished parts are consistently uniform in quality and free of blisters and porosity. By injecting material into a closed mold, flash is held to a minimum. Because close timing of the preheat-molding stage permits low molding pressures, die design may be simplified, the whole resulting in reduced die wear with consequent reduction in over-all die cost. Because of simplification, and lower over-all tool and operating costs, small-lot molding becomes increasingly practical.

AT TIME OF WRITING, Lester-Phoenix, Inc., Cleveland, Ohio, is just getting under way on production of the giant Lester Injection Molding Machine, largest of the new Lester line announced some time ago. First deliveries of this machine, which is capable of molding plastic pieces up to 32 ounces over a projected area of 150 square inches, were made earlier this year; however, hundreds of the smaller sizes have already been made for both foreign and domestic molders.

The 32 ounce machine incorporates all of the features of the standard Lester line, but on a larger scale. For example, the injection pressure at the end of the plunger is 27,000 psi; however, the makers claim that even this enormous force is easily held in check by a normal mold locking pressure of 600 tons, all of which is carried by four metal-to-metal columns.

The one-piece, cast steel frame of the machine has a cross sectional area of 240 sq. inches—the equivalent of four round steel bars of 8¾" diameter each. Platens of 29½" x 40" area are standard, and the maximum space between them is 30". The vertical injection cylinder, die height adjusting screw with are equivalent to die area, automatic ejection and separate control of both injection speed and pressure are also features of the new Lester line. However, the outstanding feature is the unusual capacity which (of possible interest to golf enthusiasts) implies coating 65 golf balls with thermoplastic at one shot.

The 32-ounce Lester Injection Molding Machine, by Lester-Phoenix, Inc., Cleveland, Ohio.



A NEW, INEXPENSIVE heating unit, by the Castaloy Corporation, 197 So. Waterman, Detroit 17, is said to answer most of the present plastic heating problems. Named the Vacu-Therm Generator and thoroughly tested, the unit is capable of delivering quick, controlled heat to 550° with a ± 5° under low operating pressures.

The generator is a heavily insulated, self contained unit with no motor, pump or other moving parts. The heat transfer medium is Dowtherm E, sealed in a heavily welded vacuum chamber. This liquid vaporizes at its efficient operating range and transfers heat through flexible conduits. The medium is an inhibitor of rust and corrosion and this, together with the absence of moving parts, provides long, trouble free life to the unit.

The Vacu-Therm Generator, by the Castaloy Corp'n, of Detroit. The unit has no pumps, motors or gaskets.

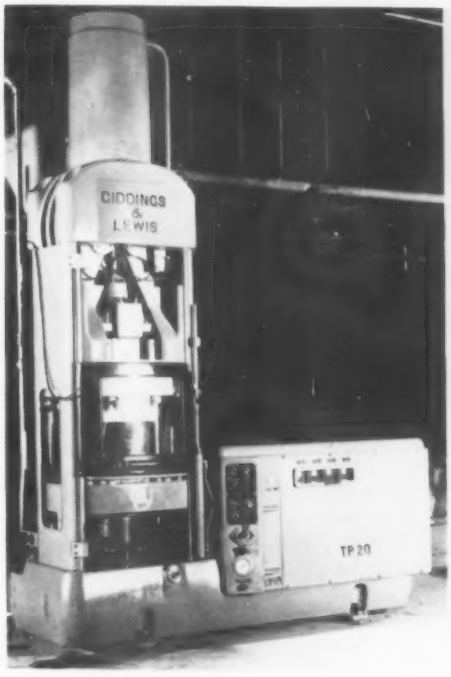
Among outstanding features claimed is low pressure; e.g., normal operating temperatures up to 400° F. require only 15 psi. The Vacu-Therm Generator is currently manufactured in three sizes—16, 22 and 33 KW capacity. Floor space required is 72" x 36"; height 50".

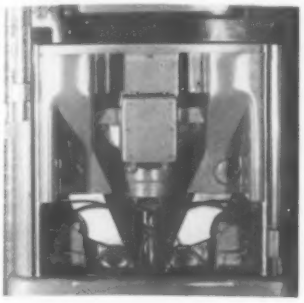
A NEW VERTICAL plastics injection press, which made its initial bow to industry at the recent Plastics Exposition at Chicago, promises new approaches to progressive plastics molding. Designed and built by the Giddings & Lewis Machine Tool Company of Fond du Lac, Wisconsin, this press incorporates vertical construction and a single hydraulic cylinder.

This departure from general plastics press design implies many advantages when molding intricate parts. For example, the single cylinder arrangement provides for clamping the mold halves together, and for injecting the plastic material into the mold cavity, in the same stroke of the piston rod.

Distinct advantages are claimed in the case of insert molding, in which the main problem has been to prevent inserts from slipping or falling since, in horizontal construction, the

...near right, the G&L Vertical Plas... Injection Press, showing single ...int adjustment for stationary die ...ate. At far right, showing how ...tical construction simplifies insert ...lding. Below, all working parts ... contained in a simple, compact ...t which includes piston rod, ...ggle, heating cylinder, injection ...nger and movable die plate.





molds are mounted with faces vertical. Hence, holding devices may be required. The vertical construction of the G & L press eliminates the need for holding devices and, as the inserts are held in position by gravity, this not only simplifies insert molding but also prevents possible damage to the mold.

Another, and a more common problem, has been that of changing heating cylinders, a chore entailing considerable machine down-time, loss of material through purging and the difficulty in handling the cylinders. The greater accessibility of the vertical design permits simplified, quick change-over, a feature that suggests having on hand a supply of heating cylinders, for different plastic materials and colors, for quick interchange.

The vertical construction also simplifies the handling of molds. For, while the overhead cylinder interferes with overhead cranes, these are not needed since the molds can be slid directly onto the platen. Another, and a very obvious advantage, is the saving in floor space effected by the vertical construction. Furthermore, all units are easily accessible since, by the simple removal of two covers, all electrical, hydraulic and mechanical devices are exposed for service or inspection.

Operation is extremely simple. When the cylinder is activated, the piston rod movement operates a toggle mechanism, shown in small photo. This initial downward movement of the piston rod locks the die plates together and, as the piston rod continues its travel, it also serves as a plunger to inject thermoplastic material into the mold. Thus, the single cylinder performs a dual function, the while effecting a considerable saving in over-all cycle time.

Centralized location of control stations, which include all push buttons and levers, provides control from a sitting or standing position. The controls may be set for manual, semi-automatic or automatic operation, and the machine will stop instantly at point of stroke reached when the stop button is pressed. Maximum safety is provided through interlocked circuits and a full view aluminum and plastic safety gate. This gate is fully automatic and does not require manual opening and closing for each machine cycle.

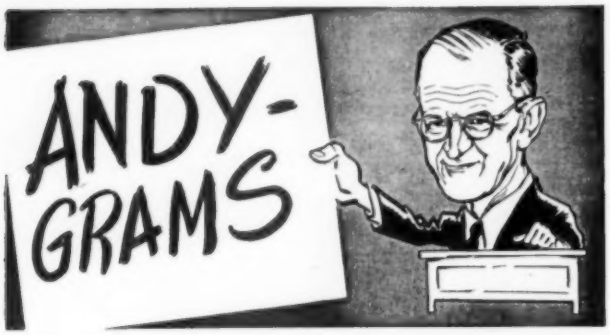
As an example of application of standard tools, rather than new equipment, to plastics processing, a large automobile manufacturer is currently obtaining high output rates in assembling metal screens to plastic radio grilles. The machines used are standard "Junior" hydraulic bench presses,

Assembling metal screens to plastic grilles, using standard Colonial Broach Company "Junior" hydraulic bench presses.

product of Colonial Broach Company, 21601 Hoover Rd., Detroit. The dies, of course, are special. The upper side, of cast iron with a score or more projecting fingers, is electrically heated with a thermostatically controlled resistance coil.

In operation, the metal screen is merely laid on the plastic grille, which is placed in the lower die. When the control lever is thrown on the machine, the upper die moves down until the heated fingers have pressed the screen into the plastic to a depth of 1/16". As the fingers "plasticise" the grille at this point, the screen is well imbedded. The head is then retracted and the completed assembly removed. The plastic quickly solidifies to hold the screen at 24 points of attachment.

An important advantage claimed for the use of hydraulic presses is that the pressure is "cushioned," thereby protecting the plastic against shocks. This is largely due to the accurately controllable stroke, of the press, by means of the standard adjustable stop. At any rate, the output per press is about 100 completed assemblies per hour, with adequate control of quality.



As FORECAST in the June Column, I finally made the long deferred visit to Sapphire Products Div'n of Elgin Nat'l Watch Company, Aurora, Ill., of which ASTEer Roger Waindle is Div'n Mgr. Roger met me at the station but, before going to the plant, had a get-together with Adv. Mgr. Ireland, who later drove me back to Chicago, and Roy Frogness who, as a consulting engineer in Aurora, is doing big things in 3-dimensional drawings along with some outstanding designing. They're live wires, those Fox River Valley boys.

Arrived at the plant, it didn't take me long to understand Waindle's pride in his company's product, or to further sense why he is such a favorite as a speaker in ASTE circles. A swell guy, capable and sincere. As for the Aurora plant, if the tiny gears, bearings and screws manufactured, among other things, were blown up to the size of similar automotive parts it would cover plenty of area. As it is, Elgin can stow an entire screw machine dep't into a packing case, although that may be a bit of reverse exaggeration.

These gadgets, however, are in the nature of a sideline to the synthetic sapphires which are being adapted to a wide variety of industrial uses. Gages that just wear and wear, abrasive powders for grinding, polishing and honing, burnishers and sizers and cutting tools and so on and on. But, I'll not jump the gun; you'll have it all in an article to come through in the near future.

In this connection, we are enjoying very gratifying responses to *The Tool Engineer* articles, readers North, East, West, South being practically unanimous in the opinion that they're right in the tool engineering groove. Jim Walker's series on Drawing Dies is going over in a big way, and the same goes for Thos. Dickinson's articles on plastics. Tom, by the way, is now an ASTE member who, I have an idea, will be put to work. The guy's a live wire.

A lot of you boys will be agreeably surprised, on going through the current book, to find that a lot of the changes you've been wanting are now coming through. For one thing, major articles have been set up so that they can be clipped out and filed without interfering with one another. As far as practical, this layout will prevail from now on.

One thing about putting out a magazine, there's never a dull moment. At times, the action is so fast that, speaking for myself, I'm like the boxer who loses track of the rounds. For one thing, we're always thinking months ahead—for example, we are now planning the fall programs during the heat (it finally got here!) of June. Right now, we've got the July book set, with this writing as a final chore.

That done, I'm trekking New Havenward a/c an invite from Ray Gifford to speak at New Haven Chapter's June meeting. As for that, I'm pinch hitting for Past Prex Al Sargent, who has to stay in town a/c Lawrence Inst. of Technology is conferring a doctor's degree on him. Well, Al had it coming, not only for his work in behalf of the Society, but for his contributions to industry in general. (Take my pulse, Doctor Sargent?)

While in New England, I hope to find time to visit Lanpelier's and Standard Machinery Company, in Providence, the idea being to get the lowdown on the latest developments in rotary swaging. For some reason—and this holds especially for the middle west—industry is not taking full advantage of the economies to be effected through swaging, and an up-to-date article on late technique will not only be timely but, in my belief, highly informative.

Speaking of New England, I ran across a news item saying that Ira R. Ames, Jr., of Waltham, Mass., is now a licensed aviator and is about to become a flying salesman for the Ames Precision Machine Wks., of which Ames Sr. is prex. The plane is a 4-place Stinson. Well, a lot of the boys are taking to the air right now, the idea being to bridge time and distance and to provide better and quicker service.

Still looking ahead, there's the Nat'l Machine Tool Builders Show, in Chicago, in September, and right on top of that the ASTE Semi-Annual in Boston, to be held during October. We just about get that settled when we start getting ready for the big ASTE Tool Show in Cleveland, next March. In spite of prophets of gloom, the exponents of progress set the pace for better things to come.

T'other day, had a pleasant visit with Charley Jenkins, from down Atlanta way, who'd come to Detroit to look the big town over and, incidentally, to look in on ASTE activities down at H.Q. On top of that, a visit with Art Jensen, of Hanna Engineering Wks., Chicago, during which (anent some reminiscences about the depression of the 30's) Art brought out that it was the automotive industry that jolted us out of the doldrums. I mention this because too many people are inclined to forget the role played by the automotive industry in putting us back on the high road to prosperity, and the beating it took while doing the job. It's still taking a beating.

While about as automotive minded as any guy could be, after forty odd years of driving, I nevertheless hold that the rail car is the cheapest means of mass transportation, the trend to busses notwithstanding. In going all-out for busses, we're simply robbing Peter to pay Paul. I refer, here, to transcontinental railways and transportation systems in big cities, not to interurban carriers or systems in small towns. There, the bus is the thing.

In big cities, the bus weaving in and out is not only a nuisance but a traffic hazard; so, for that matter, is the street car with its murderous, unprotected loading islands and the bottlenecks created by protected safety zones. What I can't understand is why city planning commissions don't advocate placing car tracks adjacent to the sidewalk, thus providing safe loading and unloading—a natural safety zone! —without subjecting passengers to the hazards of automotive traffic. This would also leave the streets clear for other vehicular traffic.

With the tracks so disposed, and given quiet, modern street cars with magnetic brakes and quick acceleration and deceleration, any large city could have adequate mass transportation at very reasonable costs. Of course, there would have to be supplementary rapid transit, and bus service as well, but rail cars would carry the bulk of surface passengers. At first thought, this line of reasoning may seem reactionary; however, rail transportation is safe, dependable and a big business that takes a lot of tool engineering and provides a lot of employment. It should be encouraged.

ASTEly yours,

Andy

Drilling and Boring Tools

Installment No. 12 of a Series

IN THE PRECEDING installment we promised that, in the next following, we would show the job under discussion properly tooled. That is, a fixture will be shown, suited to an engine lathe or turret lathe, that will embody the elements necessary to assure accuracy along with a reasonably high output. It is illustrated in Figs. 1 and 2.

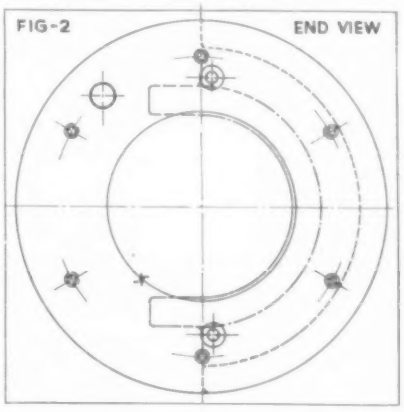
One of the "wrongs," in the preceding set-up, was the method of chucking—that is, for the lathe set-up. By chucking on the flange, without support for the opposite end, there was such overhang that the work would tend to spring away from the boring tool, resulting in chatter and inaccuracy. This fault has been corrected in the present "design," using that term advisedly. Actually, this department is not so much concerned with design as with the ways of doing.

Referring to Fig. 1, it will be seen that the fixture is attached to the spindle nose (or face plate) of the machine, with the opposite end running in an outboard bearing. Assuming that there is no play, in the spindle or the outboard bearing, the fixture should now run true and, since counterbalancing is provided, without any appreciable vibration at the comparatively high spindle speeds required for finish boring with carbide tools.

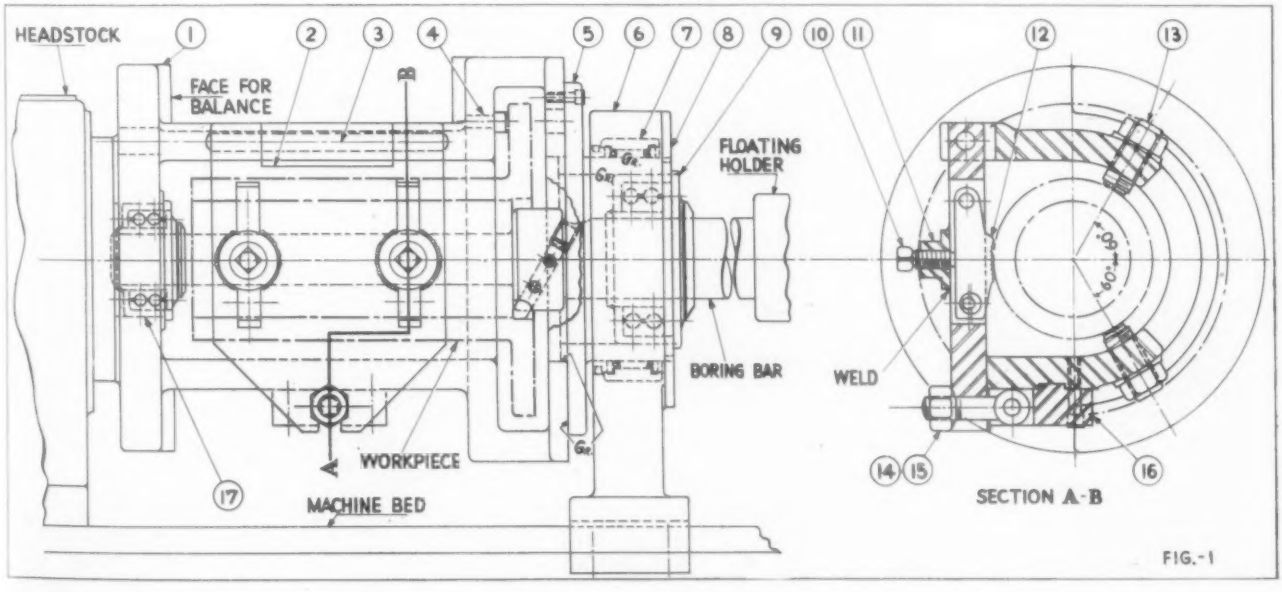
The part is located in the fixture with the flange toward the outboard bearing—that is, toward the tailstock. This permits of a considerably smaller cross section in the center of the fixture (Section A-B) and also simplifies casting and construction. The body of the fixture is a steel casting requiring comparatively little machining. Both ends are flanged, with one end machined to fit the spindle nose (or adapter) and bored for the smaller of two rotary bushings. The opposite end is bored and faced to fit the flange of the hub for the outboard bearing.

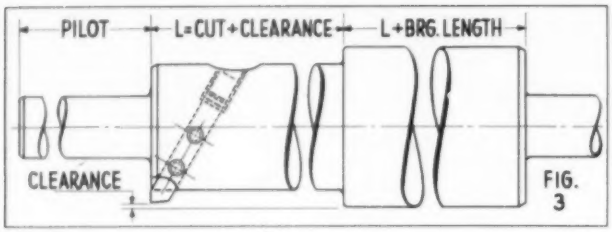
To complete the machine work, prior to assembly and set-up, the ears for the cover plate hinge pins are milled, also the pad for the hold-down screw assembly. Two banks of two holes each, at 60° off center, are drilled and tapped for the screws that make up the Vee, and the bosses spot-faced. Clearance holes, for later drilling in assembly, are located and drilled in both flanges.

The cover plate is made from boiler plate, ground both sides and shaped as shown. It is then slotted for the two jaws, and for the hold-down screw, and the hinge pin holes drilled prior to line reaming in final assembly. Also, the hinge pin holes for the jaws, as well as the stop pin holes, are drilled. Next, the two jaws are shaped, checkered and ground a free fit in the slots, after which they are located in the cover plate and the hinge pin holes reamed. The jaws are then hardened and tempered.



Next, although not necessarily in this order, the cover plate is fitted to the main casting, and the hinge pin holes drilled through and reamed. Next, the hold-down screw assembly is attached. Note the tongue and groove, to relieve strain on the attaching screws.





The hub for the outboard bearing is machined to grinding size, the screw holes drilled and counterbored, after which the part is pack hardened. After hardening, the I.D. and O.D. of the hub are respectively ground for slip fit on the larger rotary bushing, and for a close fit for the outboard roller bearing. The face of the flange is then ground, for truth in relation to the hub, and the tongue for fit in the casting. It is then assembled with the casting, and the screw holes drilled and tapped.

Next, we "sew on the buttons," which includes welding the two flanged nuts to the cover plate and completing other details of assembly. As a final operation, prior to set-up on the machine, the assembled fixture is mounted on an arbor and balanced by facing off the integrally cast counterweights on the two flanges.

The outboard bearing housing is bored a light press fit for the roller bearing, and the foot machined for fit on the machine bed, with proper height to the center line of the spindle. The dust cover is turned and fitted; then, in set-up, the housing assembly is lined up with the fixture and clamped to the machine bed. At this point, the housing can be shimmed to exact height.

While sketchy, the foregoing description of fabrication and mounting will serve for all practical purposes. Now, referring to the detail numbers, Det. 1 is the fixture casting; 2 the cover plate; 3 the hinge pin; 4 the screws; 5 the outboard bearing hub, and 6 the outboard bearing housing.

Det. 7 is the outboard bearing—in this case a McGill Multirol Bearing, single row—and 8 the cover plate. Det. 9 is a Gatco rotary bushing which, in this instance, is slip fit in the bore; 10 the clamp screws for the jaws; 11 the nuts, welded to the cover plate, and 12 the jaws. Note the keeper pin and the larger hole, which provides ample movement when clamping yet restrains the jaws when the cover plate is opened.

Det. 13 indicates the 4 screws which, to all practical purposes, form the fixed jaws of the fixture. These screws are of relatively large diameter—say 1¼"—with the ends checkered for grip on the workpiece. Once adjusted to suit the mean diameter of the part, they are retained by jam nuts. Dets. 14, 15 and 16 comprise the hold-down screw assembly. Note the ball seat, to prevent "walk" when tightening. Det. 17 is the smaller of the two rotary bushings.

Now, a few words of explanation. The four screws comprising the "Vee" are shown in the section only; however, they should be placed slightly outside the jaws, to prevent possible tip when clamping. Serrated Vee blocks could have been used, but such construction would have added to the cost of the fixture. The checkered-end screws serve equally well, besides which there is the advantage of easy replacement and adjustment in the event that the part castings should vary in diameter from lot to lot.

Jaws Used to Prevent "Walk"

While dog point screws could be used for clamping, they might tend to "walk" the workpiece during tightening; besides, the small area of the point might also tend to distort the part. With the jaws, pressure is exerted over a greater area. All things considered, then, the "design" may be considered adequate. The part is easily loaded and easily removed, the opening (shown in Sec. A-B) providing for a "tunk" with a hammer in the event that it should momentarily stick. And, the fixture will run true because of the outboard bearing.

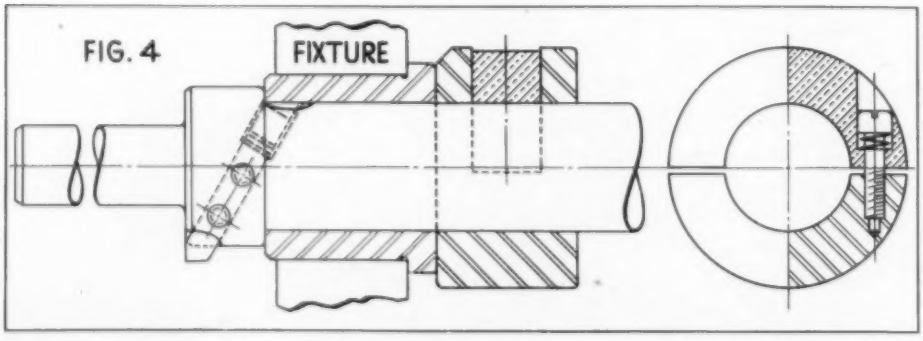
Now, a word about boring bars. It should be obvious that, since the bar must be withdrawn entirely clear from the workpiece for loading and unloading, that the cutter would strike against the lead-in bushing unless some provision were made to avoid interference. In the design shown, the bar is made with a large diameter immediately in back of the cutter. On retraction, this strikes the bushing and clears it from the fixture; then, as the bar is advanced for the next cut, the bushing is reinserted.

There are several ways to provide for clearance. One is to make the diameter of the bar, immediately behind the cutter, somewhat larger than the largest bore considered for the job. This method has the disadvantage that the bushing would have to be of considerable size, with a commensurate increase in the size of the outboard bearing, should one be used. And it is desirable that these bushings and bearings be as small as is practically possible in size. Another, and a very marked disadvantage, would be that the bar would have to be inordinately long so that the major diameter would not enter the bore. See Fig. 3.

A much better method is shown in Fig. 4. Here, a plain pilot bushing is shown, although a rotary could be used if so desired. A sleeve, provided with spring pressure actuated segment, is slipped on to the boring bar immediately in back of the bushing. In operation, the pilot bushing is retracted by the bulbous portion of the bar, which then carries the bushing with it until the bar is fully retracted.

On the return stroke, the operator slides the sleeve against the pilot bushing, continuing until it comes to rest against the cutter head. The friction is then sufficient to push the bushing into its bore; then, when the cut starts, the bar merely slides through the sleeve until the cut is completed. The segment can be made of bronze, with the body of the sleeve made of steel. Or, both can be made of bronze. There is no appreciable wear on the bar.

In this installment, we have not only presented a workable design for close tolerance boring, but have shown cause for its construction along with the "how" of fabrication. True, other designs might have served the same purpose; however, they could not deviate materially from the principles shown and still provide and maintain accuracy. We will expand on this in the following installment, along with a discussion on cutters for precision boring.



End of Part 12. Installment No. 13, this series, will follow in August issue, The Tool Engineer.

Denver Tool Engineers are charted as the 77th ASTE Chapter. Officers, at rear, are, from left: N. L. Koser, Treasurer; J. R. Matthew, Secretary; A. W. Hall, Second Vice-Chairman; T. C. Vittetow, First Vice-Chairman; B. J. Hazewinkel, Chairman and Society President W. B. Peirce, installing officer. Chapter was launched with sixty-one members

Denver Receives 77th Charter

61 Colorado Members Organize Chapter

COLORADO HAS been added to the ever-widening area served by ASTE, with the chartering of Denver Chapter, June 12.

Ceremonies inaugurating the formation of the 77th group were conducted by W. B. Peirce, ASTE President, at a dinner meeting in the Tiffin Restaurant.

After outlining the aims and objectives of the Society, President Peirce installed the newly-elected officers and presented the charter and Chairman pin to Ben J. Hazewinkel, Representative, The L. S. Starrett Co.

Other officers of the new Chapter are: First Vice-Chairman, Thomas C. Vittetow, President, Vittetow, Inc.; Second Vice-Chairman, Alfred W. Hall, Foreman, Hathaway Instrument Co.; Secretary, James R. Matthew, Engineer, Shwayder Bros., Inc., and Treasurer, Newton L. Koser, Partner and General Manager, Dart Mfg. and Sales Co.

Guest speakers were Dr. H. T. Stanford, who related personal prewar observations in Germany, and Denver Councilman MacWilliams, who told of problems confronting the new city administration.

Chairman Hazewinkel announced appointments to committee chairmanship as follows: Constitution and By-Laws, Edmund H. Malley, Special Machine Designer, Gates Rubber Co., Editorial, Leslie L. Dickinson, Tool Designer, Hathaway Instrument Co.; Membership, Robert J. Nelson, Representative, F. J. Leonard Co.; Industrial Relations, Donald N. Berry, Owner, and Standards, Conrad Eckstein, Chief Engineer, Donald N. Berry Co.; Program, Clinton J. Helton, Machine Tool Spec., The Mine & Smelter Supply Co; Public Relations, Alex H. Wilcox, Chief Tool Engineer, and Entertainment, Albert S. Yost, Asst. Chief Tool Engineer, C. A. Norgren Co., and Education, William E. Dowling, Tool and Die Superintendent, Heckethorn Mfg. & Supply Co.

Regular meetings are to be held on the first Wednesday of each month.

* * *

Denver ASTE'ers comprising the roster of 61 charter members include: Norval F. Allen, Stuart Armstrong, Willard G. Axtell, Ben J. Bakos, Robert O. Bass, Simon A. Bergauer, Jr., Clarence A. Braukman, Leland E. Cain, Ben A. Carpenter, Joseph J. Cook, John A. Dade, Jerome F. Durrie, Emery De F. Eakin, William G. Fail, John H. Field, Warren L. Foss, Fred E. Gantzler, Benjamin L. Golden, James R. Hackler, Ruben J. Hartmeister. Dalton W. Haubold, Paul V. Horst, Arthur J. Hurt, Joseph Lauinger, Arnold K. Mattson, Charles W. Mullenhour, Carl M. Overgard, Glenn R. Reece, Howard R. Schulz, George W. Scott, John W. Senn, Jr.; David V. Sprunt, John F. Stark, Albert G. Staudte, Roy J. Stenholtz, Preston C. Ward, Arthur A. Webster, Theodore R. Whiteaker, Robert L. Wilde, Dale C. Young, R. O. Anderson, Irvin L. Danielson, Sol Flax, Carl A. Norgren, Kenneth S. Redfern, Gerald E. Rich and Marion C. Rich.

Baltimore Honors U. of M. Students

MARKING ANOTHER milestone in the progress of tool engineering education, Baltimore Chapter was host, June 4, to the class of 30 students completing a course in tool design under the supervision of the Extension Division of the University of Maryland. Attendance at the dinner meeting, held in the Engineers Club, included leading Maryland educators, ladies, and Society officials.

The students, honored by the Baltimore engineers for their individual initiative in carrying on the required studies in addition to their regular employment, were taught in both day and evening classes by Professors John Buckley, former Chapter Education Chairman, and James Francey, present incumbent.

Thomas F. Burke, Chapter Chairman, introduced Dean S. S. Steinberg of the University of Maryland, who informed his audience that the University stood ready to provide courses in industrial and vocational training wherever the need should arise. During the war period, Dean Steinberg directed special training for more than 11,000 men and women.

This group of students, completing tool engineering course at University of Maryland, was recently feted by Baltimore Chapter. Standing, left to right: University of Maryland Professor John Buckley, former Chapter Education Chairman; Charles Sylvester, Baltimore Vocational Training head; Dean S. S. Steinberg of University of Maryland; Students Krauch, Bryant, Strauser and Murphy; University of Maryland Professors James Francey, Chapter Education Chairman, and Glenn Brown. Seated, from left: Students Tureck, Briel, Arnold, Dunker, Leimkuhler, Charlsen and Worsham

Professor Glenn Brown, of the University's Industrial Education Department, and Charles Sylvester, head of the Vocational Training Department of the City of Baltimore, also spoke. Mr. Sylvester stated that the Vocational Education Division had trained more than 100,000 during the war.

Professors Buckley and Francey warmly commended the honor guests for the energy and effort expended in completing their courses.

An invitation to Society membership was extended to the engineering students by Thomas J. Donovan, Jr., ASTE Director-Elect of Philadelphia.

Representing the national Society, ASTE National Editorial Chairman W. B. McClellan of Detroit commented on the significance of the occasion, unique in the organization's annals. Mr. McClellan also discussed briefly the profession of tool engineering.

A motion picture, showing the discovery and industrial development of aluminum, completed the program.

G. E. Head to Address ASTE Semi-Annual Dinner

Charles E. Wilson, President of General Electric Co., has tentatively accepted an invitation to address the ASTE Semi-Annual Dinner at Hotel Statler, Boston, November 1, it was announced at a joint meeting of the National Program Committee and the Host Chapter Convention Committee, in that city, June 13-14.

Other new developments in the fall meeting program, as determined by Robert W. Ford, National Program Chairman, and his committees, include a session to be presented Saturday morning, November 1, by the National Education Committee.

National committees indicating intention of meeting during the convention are: Judicial, Honor Awards, Handbook, Editorial, and Constitution and By-Laws.

Sightseeing bus tours, historical films, visits to radio studios and W. F. Schrafft & Sons Corp., candy manufacturers, are among activities scheduled for the ladies' entertainment.

Registration fee will be $2 for members and $3 for non-members. One registration admits a member and his wife to all events except the banquet and sightseeing tours, for which tickets will be available.

Cards will be issued to members of New England Chapters for pre-registration at their September and October meetings. The advance registration will not only save time for New England convention visitors, many of whom are within daily commuting distance of Boston, but also will permit those arriving from more distant points to enter without delay.

Naval officers were recent guests of the Golden Gate Chapter when Captain Selden B. Spangler of the United States Naval Air Station, Alameda, discussed aircraft power plant design. From left, standing: First two men unidentified, Captain Spangler, Floyd Snodgrass, Chairman; unidentified officer. Seated: Florindo Viti, Second Vice-Chairman; Ernest C. Holden, First Vice-Chairman; and I. S. Minetti, Sec'y of this active chapter in San Francisco

Super-Sonics Not to Supplant Conventional Planes

San Francisco, Calif.—"The Current Trend in Aircraft Power Plant Design" indicates that the immediate future will probably be devoted to further development of sub-sonic types, Captain Selden B. Spangler, Assembly and Repair Officer, U.S. Naval Air Station, Alameda, indicated in an address May 20 before a dinner meeting of Golden Gate Chapter.

In super-sonics, Captain Spangler predicted that planes will be pilotless and operated by a conventional mother plane, but such aircraft will not be commonly used in our time. Atomic energy, he added, is a possibility in pilotless planes.

Describing the four types of propulsion, screw-propeller, turbo-jet, ram-jet and rocket, the speaker classified propeller as best for take-off, with advantages in landing and economy; turbo-jet as faster, the power plant smaller, but twice as costly. Ram-jet, he noted, offers more improvement at high speeds in the transonic range; rocket is speedy but very expensive and the pay load extremely limited because of the huge quantity of fuel it must carry.

Jet propulsion, said Captain Spangler, is 21 years old, but progress has been retarded because metallurgists were unable to develop satisfactory high strength blade steel capable of holding together under stress at elevated temperatures. (Ed. Note: An alloy steel now being made by Timken Roller Bearing Co. is said to have sufficient strength for this purpose.)

Reciprocating and gas turbine power plants have too much to offer in general to ever be discarded and, with the development of better metals or ceramics for high temperatures, the gas turbine will find more successful power plant applications, the Captain concluded.

Following the lecture, two motion pictures were shown: one, a 1944 Westinghouse production labelled "confidential," pictured jet engines under test; the other, sponsored by General Electric, illustrated the development of airplane engines, including jet, and depicted in detail their exact operation. Models of jet engines provided by the Captain served to further illustrate the timely subject.

New Developments Assure Positive Hardness Testing

Windsor, Ont.—"Current Trends in Hardness Testing" indicate that manufacturers of testing equipment are leaving no stones unturned to give users the most modern working tools, according to Vincent E. Lysaght of the Sales Engineering staff, Wilson Mechanical Instrument Co., New York City, speaker at a recent meeting of Windsor Chapter in the Prince Edward Hotel.

Applications of hardness testing machines to single, multiple, manual and automatic operations, in many industries, were explained by the speaker aided by numerous slides.

Mr. Lysaght spoke of the many recent developments to assist industry in its search for better and more positive methods of hardness testing of materials. Beginning with the earliest types of testing equipment, the audience was taken on a journey of constant improvements and new designs.

The speaker, a graduate of Massachusetts Institute of Technology, ably answered all questions propounded by his listeners.

Other News In This Issue

German Machine Tools Ninth of Former Output

Erie, Penna.—German machine tool production is limited to approximately 11.4 per cent of 1938 output, Erik Oberg, Consulting Editor of *Machinery*, commented in reporting on his recent visit to that country as one of a group of government-sponsored technical correspondents sent abroad to study postwar conditions.

The Germans, Mr. Oberg pointed out, in a recent address before Erie Chapter, are not permitted to build seagoing ships nor roller bearings. Obstacles to revitalization of German industry are shortages of coal, food, bridges, transportation and housing.

With a living density of 2.2 persons per room and other unfavorable conditions, incidence of tuberculosis is approximately five times the prewar rate, he observed.

Immigrants to Germany he classified into three groups: expellees of German extraction returned from surrounding countries, displaced persons brought in for slave labor, and refugees.

W. B. Peirce, ASTE President, was also a speaker, discussing "Ideals and Ideas of Tool Engineers."

W. H. Schott of Pittsburgh Chapter, who represented the local group in the House of Delegates, reported on the proceedings at the Houston meeting.

Early ASTE Data Sheets To Be Listed Numerically

Detroit, Mich.—With a view to making all Society data sheets more useful to members, the Data Sheet Sub-Committee of the ASTE National Standards Committee has undertaken the preparation of a practical numerical listing for the alphabetically indexed data sheets issued during the past ten years.

The revised index, conforming with the recently compiled numerical index of current data sheets, will enable members to catalog their earlier sheets correspondingly.

Obituary

Robert F. Morley

Robert F. Morley, President of Morley Machine Corp., Rochester, N.Y., was killed May 13 in a plane crash north of Scranton, Pa.

Mr. Morley, a member of Rochester Chapter, ASTE, was returning from a business trip to New York City when the accident occurred.

Sargent Receives Degree As Doctor of Engineering

Detroit, Mich.—In the presence of an audience that overflowed the auditorium of the Engineering Society of Detroit, Albert M. Sargent, President and General Manager of the Pioneer Engineering and Manufacturing Co. here, and immediate Past President of ASTE, was awarded an honorary Doctor of Engineering degree by Lawrence Institute of Technology.

The degree was conferred during the annual commencement exercises, June 14. Dr. Edwin O. Graeffe, Lawrence Tech professor who was marshal for the ceremonies, read the citation and presented the doctor's hood to Mr. Sargent.

Dr. E. O. Graeffe of Lawrence Institute of Technology, Detroit, places doctor's hood on Albert M. Sargent, ASTE Past President, as symbol of honorary engineering degree conferred during school's commencement exercises. Right, Dr. E. G. Lawrence, Institute President

The citation reads in part: " . . . In recognition of his outstanding service to the nation and because of his many contributions to the engineering profession, the Lawrence Institute of Technology hereby confers upon Mr. Albert M. Sargent, its highest honorary degree, Doctor of Engineering. This degree although honorary in nature is more than the equivalent of a degree awarded for academic study only.

"The faculty of this college expresses the hope that Mr. Sargent will consider this degree as well earned and that he will accept all the privileges and rights pertaining thereto."

Other speakers included Herbert H. Gardner, President of the Birmingham and Ferndale National Banks of Michigan; Dr. Willis L. Gelston, Minister of the Highland Park Presbyterian Church; and President E. George Lawrence of Lawrence Tech.

Before the exercises, Mr. Sargent, Mr. Gardner, Dr. Gelston, and their wives attended a faculty dinner.

Lost Wax Process Cuts Tooling Time

Poughkeepsie, N.Y.—Time required to provide samples and get into quantity production of precision casting can be reduced from months to weeks by substituting the "lost wax method" for forging where expensive dies are necessary, Albert W. Merrick, Chief Metallurgist at Austenal Laboratories, Inc., New York City, pointed out to the more than 60 engineers attending the May 13 dinner meeting of Mid-Hudson Chapter in the YMCA.

Castings made by the "lost wax process," Mr. Merrick explained, are fine-grained, smooth and to close tolerances as compared with sand casting.

Steps in the process, as outlined by the speaker, are: Machining metal master pattern, casting soft metal master mold, producing wax pattern in the master mold, and pouring an indenture or mold around the wax pattern which is melted out leaving the final mold ready for production of fine precision castings.

Several castings are made in one unit with the maximum weight of a unit, made under present conditions, averaging five to six pounds.

Mr. Merrick's talk, illustrated by slides and samples, was followed by a lively question period.

Richard J. O'Neill, of the International Business Machines Engineering Laboratories and a Chapter member, also spoke on "Personal Reminiscences of Our Entry into Japan." He showed colored slides of Okinawa and Tokyo.

Research Institute Holds Open House for Engineers

Columbus, Ohio — For their May meeting, Columbus Chapter and their guests, including six from Dayton Chapter and 25 from Springfield Chapter, visited Battelle Memorial Institute, on the 14th.

The various shops, laboratories and extensive technical library, that make up the non-profit organization devoted to industrial research, were shown to the visitors. Guides answered questions and explained the functions of the many departments where the Institute solves manufacturers' problems at cost, handling anything from process improvement to plant design.

All information, coyprights and patents obtained become the property of those requesting the research, the engineers were told.

Columbus Chapter members assemble for tour of shops, laboratories and library at Battelle Memorial Institute

C. A. Salmonsen, Works Manager of local General Electric plant, urges cooperation with design engineers in talk before Philadelphia Chapter. Right: General Electric table at the dinner meeting held in Philadelphia

Niagara District Chapter officers are, from left: Howard A. Wood, Treasurer; Russell R. Wood, Second Vice-Chairman; William L. Sandham, Chairman; Norman B. Coleman, First Vice-Chairman, and Ernest L. Morley, Secretary

Humans, Greatest Problem In Time and Motion Study

St. Catharines, Ont. — Time and Motion Study was the topic of discussion at the May 8 meeting of Niagara District Chapter, 90 members attending the session at the Queensway Hotel.

J. Henderson of the Supervisory Staff, J. D. Woods & Gordon, Ltd., Toronto, the guest speaker, described his subect as a systematic approach to the analysis of a job to eliminate or combine motions to reduce costs and increase efficiency.

People Difficult to Engineer

Human engineering, he said, is the biggest problem presented in time and motion study as people are reluctant to accept new ideas, resist changes, and resent criticism. Creative imagination, the speaker continued, is so rarely found that it should be encouraged rather than opposed as the inclination is to spend more time in retrospect than in prospect.

Labor-saving improvements and devices create rather than reduce employment by furnishing better and easier methods and releasing workers for other jobs, he reminded.

In closing, Mr. Henderson emphasized "we must never forget there are always better ways to do things if we are ingenious enough to find them." The talk was illustrated with three sound films.

In a short after dinner talk, D. F. Thom, President of St. Catharines Rowing Club outlined the sport of rowing, stressing condition, co-ordination and courage as necessities. Mr. Thom praised the Henley Regatta, held annually since 1903, as the finest of its kind on the North American continent.

Russell Wood, Chapter Second Vice-Chairman and coach of the St. Catharines Rowing Club introduced Mr. Thom.

Asks Development Program To Assist Industry

Philadelphia, Pa.—The tool engineer is today a victim of his own creation. Specialization, mass and straight line production and skilless jobs have lowered costs and increased production, but something must be done to stimulate resourcefulness and leadership, according to C. A. Salmonsen, Works Manager of General Electric Co., Philadelphia.

Speaking before 150 members and guests of Philadelphia Chapter, Mr. Salmonsen cited industry's progress in specialization with a partial breakdown of manufacturing operations.

Product Design Cost Factor

Relationship of product design to manufacturing costs, he asserted, cannot be minimized. The tool engineer and design engineer must cooperate so that the product can be made for a salable price.

Although industry did an excellent war job, it was achieved at a cost, reminded Mr. Salmonsen. The tool engineer must now prepare for industry's future by initiating an inventory and consideration of a training and development program involving: a. Technical papers and presentations in local and area competition for awards or prizes; b. Plant visitations for observation and general knowledge; c. Justification of high cost tools and frills; d. Information on job requirements; e. Lower overall costs instead of a lower single element cost; and f. Study of tool life and capacity.

Guests Give Testimonial

Several Baltimore Chapter guests, Thomas Burke, Chairman; W. D. Winger, Past Chairman; G. A. Exley, Delegate and First Vice-Chairman; and E. Rogers, joined with the Chapter in paying tribute to Thomas J. Donovan, Jr., Philadelphia member elected to the ASTE Board of Directors.

General Electric guests included Emil Schaeffer, Works Manager; Thomas Collings, Industrial Relations Dept.; and Burt Mahoney, Assistant General Superintendent.

The Chapter inaugurated its membership drive with the introduction of 18 new members.

A film, "Railroadin'," shown through the courtesy of General Electric Co., concluded the program.

Typewriter of 1952 Now Being Developed

Elmira, N.Y. — New typewriter models for production from 18 months to five years in the future are being designed by research workers, according to George W. Fotis, Director of Sales Promotion, Typewriter Div., Remington Rand, Inc., New York City.

Next year marks the 75th anniversary of the typewriter industry, founded in 1873 at Ilion, N.Y., through the inventiveness of Christopher F. Sholes and the production "know-how" of gun makers and Remington & Sons, Mr. Fotis told Elmira Chapter members meeting May 5 at the Mark Twain Hotel.

English Inventor Failed

The speaker related the first recorded attempt to develop a writing machine in England 233 years ago by Henry Mills. This was unsuccessful as were other early attempts. Ridiculed at its inception as were the steamboat, automobile and other modern developments, the typewriter has made similar advances, he pointed out.

He quoted excerpts from a speech by Charles Kettering, indicating that American business had been revolutionized by this invention, with approximately 3,000,000 machines in use, largely by women.

While various changes in the standard keyboard have been proposed, any re-arrangement of keys would require extensive retraining of operators, the speaker stated. Keyboards are available in myriad type styles and for 150 languages, he added.

Quotes Clemens Quip

Mr. Fotis recalled that Mark Twain, said to be the first author to use a typewriter, once wrote the Remington company a humorous letter terming the invention "a practical little joker" which he would no longer use for correspondence because he would be deluged with replies asking him to describe the wonderful invention that could write type.

In the business meeting which preceded the technical session, Chairman Edward Stachel presented a Past Chairman pin to Floyd B. Allen.

Mailing Machine Income 25% of Postal Revenue

Bridgeport, Conn. — Metered mail collects nearly one-fourth of the United States postal revenue and is used by 71 countries around the globe.

These facts were presented by H. M. Nordberg, Postage Meter Sales Manager of Pitney-Bowes, Inc., in an illustrated lecture before the largest assemblage of members and their guests in the history of Fairfield County Chapter.

The occasion was the May 7th meeting held at Stamford in the Pitney-Bowes new auditorium. More than 250 were in attendance.

The manufacturing precision that lies behind the machines used for printing government postage by licensed private users was illustrated by guided tours through the plant. The tours were supplemented by table displays of precision parts in which nearly every known machining or finishing process was represented.

Fred Bowes, Jr., Advertising and Public Relations Manager of the company, welcomed the members and touched on American industry's dependence on tool engineering.

In a brief business meeting, Chairman A. R. Hunt announced the appointment of M. B. Whiting to the publicity and public relations post, succeeding Thomas Fish who is retiring from the office.

Men are homesick amid this sad mad rush for wealth and place and power. The calm of the country invites and we would fain do with less things and go back to simplicity.

—Elbert Hubbard.

Sea Holds Magnesium In Unlimited Supply

Los Angeles, Calif.—Sea water provides a virtually inexhaustible source of magnesium, with a content of nine or ten billion pounds of the metal in every cubic mile of ocean.

In its pure state, magnesium is soft and possesses low strength, James V. Winkler, Mechanical Engineer, Dow Chemical Co., Midland, Mich., explained to Los Angeles members at a recent Chapter meeting. Alloyed with aluminum, manganese or zinc, it combines light weight with favorable strength characteristics.

Referring to misconceptions concerning corrosion resistance and fire hazard, Mr. Winkler pointed out that accelerated salt water tests on magnesium resulted in an electrolytic action through contact with other metals, not present in the normal use of the metal, even in salt-laden atmosphere.

Magnesium will not burn, he added, until it reaches the melting point, between 1100° and 1200°F. Precautions should be taken in machining to avoid excessive heat which might melt and ignite small chips.

In forming magnesium, the speaker continued, the same equipment is used as in fabricating other common metals. Forming in a heated state permits fabricating of parts in fewer operations; reduces springback, and load on the forming equipment; and results in elongation permitting parts to be stretched at room temperature and size corrected by adjusting the temperature at which a draw die is operated.

Drawing, die design, lubrication, spinning and other forming techniques were also discussed by the speaker.

Fairfield County members enjoyed dinner hospitality of Pitney-Bowes, Inc., Bridgeport, Conn., before being escorted through the mailing machine plant. Mechanical functions of postage meter are explained to group

Thomas Demonstrates Electrical Wonders

Hartford, Conn. — Comparing the achievements of modern science to the fabled magic of Aladdin's lamp, Dr. Phillips Thomas, Westinghouse Research Engineer, demonstrated the wonders of electronics during an address, "Adventures in Research," given before 375 members and guests of Hartford Chapter, ASTE, and the New Britain Industrial Council.

The occasion was the Third Annual New Britain Night, held lately at The Hedges, New Britain, and cosponsored by the two organizations.

Dr. Thomas, in a radar demonstration, set fire to steel wool, lighted a cigarette, and proved, by lighting lamps held by two men in the audience, that radar waves could be diverted or passed through opaque material.

He traced the development of radio through the observations and inventions of Maxwell, Hertz, Marconi, Fessenden and DeForest, then demonstrated the short wave sender and other apparatus.

The lecturer also showed how whirling blades appear under the stroboscopic lamp, used to check the balance of airplane propellers as well as in other industrial fields.

Ultra-Violet Reveals Minerals

Dr. Thomas explained ultra-violet rays, using a lamp to show their effects. During World War II, he said, ultra violet rays were directed on the slopes of the Rocky Mountains, revealing by fluorescence the presence of valuable minerals in the rocks.

Clarence Hubbard, an insurance official, served as a very entertaining toastmaster. Among other speakers introduced by Mr. Hubbard, were I. F. Holland, ASTE First Vice-President, who brought the greetings of the National Officers and Board of Directors, and Chairman Richard Smith who described his trip to Houston and the activities at the Annual Meeting.

Distinguished guests at the speakers' table included: James P. Baldwin and P. C. Barth, Vice-Presidents of American Hardware Corp.; Stanley Hart, President, Tuttle & Bailey Co., Inc., and of Hart & Cooley Co., Inc.; Arthur McEvoy, Editor, *New Britain Herald;* Henry Winterbottom, Chairman, New Britain Industrial Council; Elmer T. Carlson, President, Trumbull Electric Mfg. Co.; Arthur E. Thornton, President, Skinner Chuck Co.; and Fred L. Morrow, President, North & Judd Mfg. Co.

Radar Engineer Explains Controlled Plane Landing

Baltimore, Md.—One of Baltimore's wartime "top secret" developments, radar controlled airplane landings, was discussed at a meeting of Baltimore Chapter, May 7, in the Engineers Club.

Fred J. Kitty, Project Engineer at the Bendix Radio Div. of Bendix Aviation Corp., Towson, who participated in the design and manufacture of the radar "talkdown" system of landing planes on fogbound airports, was the speaker.

Instrumental in designing some of the first fixed GCA's (Ground Controlled Approaches), Mr. Kitty described their application to civilian aviation, and the tool engineer's part in developing the landing guide.

Released for Civilian Use

Only recently removed from the restricted list by military officials, GCA is now in use at the Chicago, Washington and New York airports for landing commercial aircraft. It is also operated on more than 38 navy airfields.

The speaker augmented his lecture with an army training film illustrating the use of the intricate system.

Robert O. Bonnell, Chairman of the Baltimore City Aviation Commission, in a previous talk, related the history of flying, his experiences with aviation programs and the possibility of future expansion of private flying.

Mr. Bonnell also outlined plans for the new Baltimore Airport now underway and the modern facilities that will be available. His guest, General Moore, recently appointed Director of Expansion for Baltimore Airport facilities, was introduced to the audience.

Ladies Entertained

Hamilton, Ont.—Approximately 130 Hamilton Chapter members, their wives and friends spent an enjoyable evening May 9 on the occasion of the Chapter's Annual Ladies Night.

Principal speaker was Peter Gellatly, of Canadian General Electric Co., who presented films on television and railroading.

Entertainment was provided by "Scotty" MacGillvary and company.

Peter Gellatly of Canadian General Electric Co., tells Hamilton Chapter about television, following dinner (right) which opened Annual Ladies Night program

Tomorrow's Engineer Must Tool Atom for Industry

Detroit, Mich. — "With the aid of the scientific world, the tool man will ultimately have to design the harness for the atom," said Carlton F. Worfolk, Assistant Editor of the "Tool Engineers' Handbook," in a published interview with *The Detroit Times.*

"Those who fail to read up on it and keep abreast of its progress will be hopelessly out of date within another 10 years," he warned.

Law and medicine were among other fields Mr. Worfolk cited as being profoundly affected by nuclear fission.

"You will live to see your own newspaper printed by radiation," Mr. Worfolk told the *Times* reporter, "much as they make blueprints today, but on an advanced scale.

"Why should newspapers set type in costly metals when a printer could typewrite master sheets which could then be transferred to sensitized newsprint by means of radiation?

"It should be a general practice within 20 years," he predicted.

Student Group Entertains Parent Chapter Members

Kansas City, Mo. — Kansas City Chapter met May 7 with their student group at the University of Kansas in Lawrence. The meeting was sponsored by the approximately 40 engineering students affiliated with the Chapter.

Dinner was served to the members at Fred Harvey's Pine Room before making the 40-mile trip in a chartered bus. The program was presented by The Linde Air Products Co., with P. O. Wade demonstrating heliarc shielded welding. Welding equipment in the University machine shop was used for the demonstration.

Talks on Superfinish

Fort Wayne, Ind.—J. R. Keen of Gisholt Machine Co., Madison, Wis., was technical speaker May 14 at a meeting of Fort Wayne Chapter, held in the Chamber of Commerce.

Mr. Keen talked on Superfinish, using slide illustrations of machines developed for the process. Interest in the subject was apparent from the many questions asked the speaker at the conclusion of his lecture.

Rev. F. Westerndorf of St. Joseph Church, Hessencassel, gave a dynamic after-dinner address, "Americanism."

Advocates Sharp Tools For Long Broach Life

South Bend, Ind.—The most important element for obtaining long broach life is keeping the tool sharp, Kenneth N. Macomber, Chief Engineer, The Lapointe Machine Tool Co., Hudson, Mass., informed South Bend Chapter at their April meeting, indicating that surface smoothness of one to ten micro-inches could be attained with proper broaching equipment.

Mr. Macomber gave a brief summary of broaching before showing two color films, the first of which pictured in detail the making of a broach from the first turning of the steel on the lathe to the finished tool being packed for shipment. Broach manufacture, the motion picture revealed, is a very delicate process, requiring constant inspection during the numerous machining, heat treating and grinding operations.

"Surface Broaching," the second picture, gave a graphic demonstration of the effective use of broaching in speeding the production of many everyday products such as electric iron bases, end wrenches, pliers and numerous automobile parts.

Mr. Macomber conducted a question and answer session after showing the motion pictures.

* * *

Speaker at an earlier meeting was J. T. Welch, Machine Tool Sales Div., The Sheffield Corp., Dayton, Ohio. Mr. Welch, in a lecture on "Crush Dressing of Grinding Wheels," named as advantages of crush dressing: The whole grains of the abrasive are removed; the remaining grains are not dulled; the process is faster than the use of a diamond; the wheel does not load or glaze as readily; forms can be crushed that would be impossible to form with a diamond.

Mr. Welch cited numerous examples of grinding on gears, special threads and other complicated shapes at a much faster rate than ever before. Steering wheel worm gears, he added, are now being finish ground after hardening, thereby decreasing the amount of reject formerly caused by warpage and nicks in handling.

On straight surfaces, the speaker said, crush dressing cannot compete with diamond dressing because of the necessity to stop the grinding wheel for the crushing method. For long, narrow slots, straight side walls or radii of less than five-thousandths. crush dressing cannot be used, he pointed out.

Economy and Simplicity Air Cylinder Advantages

South Bend, Ind.—Air cylinders to power machine tools are gaining in popularity through simplicity and low cost, according to K. J. Heinzelman, Sales Manager of the Bellows-Senacon Co., Akron, Ohio.

Mr. Heinzelman, speaking before the May meeting of South Bend Chapter, stated that the use of air cylinders is limited to thrusts below 5000 lbs. Heat, built up by compression, and water, formed by condensation, must be compensated by after-coolers and properly installed manifolds.

Hydraulics Eliminate Bounce

While the conventional air cylinder has a bounce action harmful in most machine tool operation, the Bellows company, he added, has developed a hydraulic check to overcome resiliency.

The speaker presented two films on "Controlled Air Power Devices in Industry."

Earlier in the evening, the YMCA Toastmasters Club presented a short public speaking program. T. Walsh, President of the club, explained that the organization's purpose is to help the individual express his ideas before a group of people.

Chapter members assisting Mr. Walsh were: Frank Deitle, Horace Wentzell, Joseph Head, Carl Stevason, Donald McFall, William Snyder, John Galbraith and Norman Shafer. Two five-minute speeches were given by Al Roberts and Richard Coggan, members of the Toastmasters Club.

I.B.M. Host for Tour

Binghamton, N.Y. — A three-hour tour of the International Business Machines Corp. plant at Endicott, was the highlight of a dinner meeting of Binghamton Chapter held May 7 in the company cafeteria.

C. F. McElwain, I.B.M. Plant Superintendent, welcomed the group, briefly reviewed the company's history and development, and outlined the tour in which the more than 150 members and guests later participated.

H. D. Mozeen, of Syracuse, National Membership Committeeman, spoke on the Society's drive for new members.

R. B. Andrews, Chapter Chairman; R. E. Coles, Vice-Chairman; and R. K. Brewer, Program Chairman, all members of the I.B.M. staff, were in charge of the event.

Presses Proved Capable Of Automatic Production

Grand Rapids, Mich. — Presswork problems confronting Western Michigan members were ironed out by William W. Schug, Sales Manager of The V & O Press Co., Inc., Hudson, N.Y., in a program entitled "Presses Geared for Automatic Production," presented at a meeting May 12 in the Rowe Hotel.

Slides and a film showing various successfully executed production jobs augmented Mr. Schug's address. During the ensuing open discussion, the speaker imparted additional technical information in any extremely interesting manner.

Conditions in Europe and the impact of American and Russian influences on the people of the distressed countries were described by John B. Martin in an after-dinner talk. Group singing was enjoyed before and after dinner.

Among the 55 members and guests attending the meeting were H. E. Conrad, Executive Secretary, and C. J. Hasse, Office Manager, from the ASTE Central Office at Detroit.

New Address, New Size

Beginning with this issue, THE TOOL ENGINEER is being printed in Lansing, Mich., at Franklin DeKleine Co., largest printing plant in Michigan.

Editorial and advertising offices of the publication are being relocated at 550 W. Lafayette Blvd., Detroit 26, Mich., in the heart of the publishing district and within a few blocks of the ASTE Central Office.

Chapter and members news, technical contributions, advertising copy and instructions should be sent directly to the Detroit address. Advertising plates are to be shipped to the Lansing TOOL ENGINEER office, 315 N. Grand Ave., Lansing 1.

The smaller trim size of THE TOOL ENGINEER has been adopted in order to conform with the standard sizes prevailing in the technical press and also to accommodate bleed page advertisers who will no longer need to make special plates for THE TOOL ENGINEER.

Dinner at the International Business Machines Corp., precedes three-hour trip through plant or more than 150 Binghamton Chapter members and their guests

Members of Rochester Chapter chat with community's industrial executives during dinner preceding recent educational session. Top right: Dr. Mark Ellingson, President of Rochester Institute of Technology and featured speaker, emphasizes importance of specialized engineering education. Below: ASTE President W. B. Peirce states industry's need for well trained engineers to an audience of 425 members and guests. At his left is M. L. Roessel, Chairman of the Rochester Chapter

Scores General Education In Specialized World

Rochester, N.Y.—Four hundred and twenty-five members and guests of Rochester Chapter gathered recently to hear Dr. Mark Ellingson, President of Rochester Institute of Technology discuss "Education for Tool Engineering" at an executives' night dinner in the Rochester Chamber of Commerce.

This phase of education, Dr. Ellingson pointed out, is now entering the social structure. Through the ages, subjects were added to study courses as required by society, but each met stiff opposition and had to fight its way into the curricula of schools and colleges. Tool engineering is undergoing such a struggle today, he added.

"All-Purpose Man" at Disadvantage

The "all-purpose man," graduating from an institution generalizing in fundamental subjects is just as handicapped as an all-purpose machine and can never compete successfully in a specialized field, he declared.

Colleges fear that the addition of tool engineering to their programs will add to the length of their courses. Many, set up on a production line basis, are reluctant to make changes unless forced.

Dr. Ellingson concluded his talk by saying that a specialized program must be carried out to give each student the best education for his particular needs.

Milton Roessel, Chapter Chairman, briefly outlined the work accomplished through the cooperation of the Rochester Institute of Technology and Rochester Chapter, ASTE, in setting up the first ASTE three-year school engineering course.

W. B. Peirce, ASTE President, outlined the history and rapid growth of the Society. Industry's need of tool engineering, he stressed, demands well-established courses in the required subjects at technical schools and colleges.

Recorded history proves that tool engineering originated with the cave man, Lewis B. Swift, President of Taylor Instrument Co., stated in a brief talk concerning Rochester's reputation for precision production which is dependent on tool engineering and tools properly maintained.

Other distinguished guests introduced by Chairman Roessel were: F. Ritter Shumway, Vice-President, Secretary and Treasurer, The Ritter Co., and President, Rochester Chamber of Commerce; Milton E. Loomis, Executive Vice-President, and R. W. McCarthy, Manager of Industrial Management, Rochester Chamber of Commerce; Otto W. Winter, Chairman, ASTE National Education Committee; and Charles E. Codd, former Chapter Chairman and Historian.

During the after dinner group singing, conducted in a spirited manner by David Harvard, the officers and other speakers' table guests complied with a request to sing for the group.

See Aluminum Extracted By Bonneville Dam Power

Portland, Ore.—Production of pig alumninum at the Vancouver, Wash., plant of the Alumnium Co. of America was shown the 60 members and guests of Portland Chapter participating in a plant visitation May 28.

Rectifiers and transformers, required for the electrolytic process utilizing 172 magawatts of the hydroelectric power of Bonneville Dam, were inspected. Electric potlines and alloying furnaces were among the processing equipment seen by the group.

Removal of molten aluminum from the pots by siphoning was also shown. Laboratories, the carbon plant and the machine shop were opened and thoroughly explained.

Following dinner at the Chamber of Commerce, a comprehensive film, "This Is Aluminum," was shown prior to the plant visit, familiarizing the members with the various processes required to make aluminum sheets and bars from bauxite and emphasizing the value of the abundant hydroelectric power of the Northwest.

Canadian Diesel Output Valued at $3,000,000

Montreal, Que. — A. Hugh Paton, Chief Engineer, Diesel Div., Dominion Engineering Works, Ltd., was guest speaker May 14 at the closing meeting of the season for Montreal Chapter.

In describing the growth of the Diesel engine industry in Canada, Mr. Paton quoted figures indicating that the value of such engines produced in the Dominion increased from $87,000 in 1935 to an estimated $3,000,000 ten years later.

Uses of Canadian Diesels, he continued, are widespread, falling principally into two categories, stationary and marine generating sets for electric power and marine propulsion.

A series of slides, showing cross sections of the various types of engines and clearly demonstrating the Diesel principle, illustrated the talk. Keen interest was exhibited in the photographs of several actual applications, particularly in ship installations. A highlight was the description of the new Diesel-powered, icebreaking ferry, *Abegweit*, built to carry railroad cars and automobiles between Borden, Prince Edward Island, and Cape Tormentine across the Northumberland Straits where bad icing conditions are frequent.

Pointing out that considerable research and development are necessary in order to compete with engine manufacturers in countries where larger markets permit greater volume of production, Mr. Paton showed how his company set up a costly department for this purpose.

A film, "Precision," shown through the courtesy of Canadian Industries, Ltd., demonstrated the extreme accuracy demanded in the manufacture of shot gun ammunition. Of particular interest was the sequence showing high production, fully automatic presses, also the close control of dimensions observed through the use of "go" and "no-go" gauges at every stage of production.

Credits Advertising for Mass Production Demand

Toledo, Ohio—Only mass production markets, created by consistent national advertising, made it possible for a well-known toilet soap to be sold at the same price for 60 years, despite wages 10 times increased, raw materials doubled in price, and soaring Federal taxes equal to labor costs, H. D. Bissell, Advertising Manager of The Electric Auto-Lite Co., emphasized in discussing "Do Hucksters Earn Their Keep?" before a meeting of Toledo Chapter members, May 14.

In proof that advertising builds good will, Mr. Bissell mentioned a representative list of stocks on the New York Exchange, pointing out that the public's estimate of the asset value (as represented by stock price) of those who are national advertisers is substantially above that of the non-national advertisers. In other words, he explained, the worth of a corporation in the public's eye is reflected in its understanding of a company, its knowledge of its products and its confidence in the responsibility of the corporation.

Good Will Exceeds Assets

Citing another example of what advertising can do in winning consumer acceptance, Mr. Bissell referred to a motor car company, sold to a New York firm in 1941, which still carries the founder's name. Sales price of the good will alone in this transaction was 105 per cent of actual asset value, representing a dollar total many times the amount spent in advertising over a number of years.

To demonstrate how advertising can help sell a commodity, a famous correspondence school was quoted as having spent 10 million dollars in advertising over a period of 35 years. During that time, the school received $9 for every $1 spent, as a direct result of inquiries from its advertisements.

Advertising, he added, sells goods economically. In house to house selling, four visits cost about $1.60. By direct mail, postage is three cents per call. Through national magazines, the sales message is one cent each. Advertising must be a continuous program to be successful, since older customers die and younger ones grow up ignorant of a product. Many famous products have disappeared, the speaker reminded, because the manufacturer felt there was no further need to advertise.

Recalling the tremendous program carried on by the War Advertising Council to sell war bonds, promote victory garden projects, Red Cross and other campaigns, Mr. Bissell related a recommendation recently received by its successor, the Advertising Council.

Economic Education

The recommendation proposes that its sponsors, a joint committee from the Association of National Advertisers and the American Association of Advertising Agencies, prepare a presentation to secure cooperation of top management, and an educational campaign on how and why the American economic system functions, using advertisements, booklets, motion pictures, radio and other media.

Object of the projected program would be to educate those who are uneasy about the future or otherwise disgruntled and ripe for subversive propaganda, thus promoting economic literacy to help preserve our American way of life.

During his address, Mr. Bissell and his assistants illustrated radio advertising techniques with a record player, placards showing results of program popularity polls, and a collection of forty thousand letters, mailed in response to an offer of an autographed photograph of a radio star.

ASTE to Sponsor Session At Machine Tool Congress

Chicago, Ill.—Through its Chicago Chapter and in cooperation with the Machine Tool Congress to be held here September 17-26, ASTE will sponsor a technical session, Wednesday evening, September 24, at the Furniture Club of America, 666 North Lake Shore Drive, Chicago.

Speaker and subject will be announced in a subsequent issue of *The Tool Engineer*. Dinner reservations should be made as early as possible through the Society's Central Office, 1666 Penobscot Bldg., Detroit 26, Mich.

The September and October meeting schedule of Chicago Chapter will be adjusted to accommodate the Machine Tool session.

Nearly 200 See Auto-Lite Plant Operations

Toledo, Ohio—One hundred and eighty-three members and friends of Toledo Chapter were recent guests of the Champlain Street plant of The Electric Auto-Lite Co.

Samuel W. Burgess, a Past Chairman of the Chapter and member of the Auto-Lite staff, headed the welcoming committee who escorted the visitors through two large buildings.

Among interesting operations shown in the manufacture of automobile starters, generators, circuit breakers and distributors, as well as miscellaneous parts for other plants, were coil winding, forming and welding of starter and generator covers from flat stock, and automatic stamping of laminations.

The trip was climaxed with a buffet lunch served during the showing of a motion picture featuring operations in other company plants and a parade of products from its 23 branches.

Annual Social Event Honors Ladies

Chicago, Ill.—A memorable occasion for Chicago Chapter was the Annual Ladies Night, held May 2 in the Furniture Club of America. More than 300 members and their guests attended the yearly function devoted to good fellowship, and diversion provided by the Entertainment Committee.

Dinner, to the accompaniment of strolling musicians, started the festivities. After dinner Chairman Fred J. Schmitt presented his predecessor, Clare Bryan, with a Past Chairman pin. A number of attendance prizes were also awarded.

Vincent Gottschalk, as master of ceremonies, introduced leading entertainers from local night clubs, including Georgie Gobel and Eileen Garden, singers; Jackie Burtell, tap dancer, and the five Leonards, a feminine acrobatic troupe.

The remainder of the evening was spent dancing to the rhythm of Chuck Cavall's Orchestra.

Ladies Night at Chicago Chapter is annual social event. A memorable evening of entertainment and dancing followed this gala dinner in Chicago's Furniture Club

Springtime at Rose Hill Bulb Farm, Gresham, Oregon, home of Eugene Butzer (inset), brings acres of daffodil and Dutch iris blooms as by product of the engineer's hobby. Bulbs have nationwide distribution to home flower lovers

West Coast Bulb Farm Hobby Produces Acres of Gold

Gresham, Ore. — Three years ago when Eugene Butzer, Chief Tool Engineer for the Iron Fireman Mfg. Co., Portland and Cleveland factories, bought a farm in the foothills of Mt. Hood, he found himself the owner of 11 acres of the best Oregon loamy soil, suited for either strawberry or bulb culture.

Deciding on floriculture, Mr. Butzer, organizer and first Chairman of Portland Chapter, ASTE, named the tract "Rose Hill Bulb Farm" and began the hobby which now supports three-quarters of an acre of golden daffodils in many shades and such varieties as Helios, King Alfred, Queen of the North, Spring Glory, and Silver Star. In a field of similar size are row on row of exquisite Dutch Iris—Blue Wedgwood, Yellow Queen, Dark Blue Imperator and White Excelsior.

To Increase Plantings

"Right now," he says, "I expect to put in two more acres, gradually increasing the bulb plantation by about one-half acre per year."

The spring-blooming tubers keep the Portland engineer busy throughout the entire growing season, first with Bordeaux sprays to discourage insects from destroying the iris, and frequent cultivation of the three-foot space between the double rows, to keep weeds down and the ground friable. In March he is rewarded with a sunburst of daffodil bloom, followed by the tri-color iris display in May.

"Digging of the bulbs," be explains, "takes place in July when the ground is dry. After being dried and sorted, the larger bulbs are prepared for market, the daffodils being fumigated with strong cyanide gas to prevent disease."

Daffodil bulbs, grown for market in the rich Oregon loam and mild Pacific coast climate, are 2-inches to 3-inches in diameter; the Dutch Iris range from ¾-inch to 1½-inches. Throughout the late summer and fall the remaining bulbs are replanted.

"Nationwide distribution," Mr. Butzer comments, "is usually handled through brokers, but bulbs are also sold in small lots direct to home flower lovers."

Choice, selected bulbs, Government inspected and carefully packed, "they will produce outstanding flowers anywhere," their grower proudly asserts, adding, "American grown bulbs have proven superior in quality to foreign imports because of their large size and freedom from disease."

Tool engineering becomes an adjunct to the farming project, for ASTE'er Butzer has a new planting and digging unit on the drawing board. His present equipment consists of a standard Ferguson type tractor with cultivator, planting ridger, and single plow to dig bulbs.

"Now, the farm is merely a sideline, but in the future," Mr. Butzer confides, "it may become my livelihood. When I'm able to grow plants for marketing flower buds the year 'round, I hope to give my full time to this interesting hobby. In fact, I'm working on a greenhouse for this very purpose."

New Non-Crushed Abrasive Lowers Grinding Costs

Pittsburgh, Pa.—Gordon T. Rideout of Norton Co., Worcester, Mass., was guest speaker at the May meeting of Pittsburgh Chapter, discussing "The New Non-Crushed Abrasive and Its Meaning to Industry — No. 32 Alundum."

After briefly tracing the history of abrasives, Mr. Rideout unfolded the story of the new aluminum oxide development. No. 32 Alundum, he explained, presents many possibilities for lower costs in all grinding operations, needed few redressings, with the additional advantages of longer wheel life and cooler, faster cuttings while using heavier down feeds.

A series of slides, illustrating the outstanding merits of the new abrasive, was followed by motion pictures depicting its superiority.

The dinner meeting and technical session were attended by 110 members and guests.

New Members Recruited At Kenosha Meeting

Racine, Wis.—At a dinner meeting held May 5 in the Elks Club, Kenosha, several local tool engineers accepted Racine Chapter's invitation to membership and a number of other guests in the audience of approximately 100 expressed a desire to become affiliated with the organization

The technical program, presented by Snap-On Tools Corp., featured a sound film, "The Story of a Wrench," showing the manufacture of wrenches from steel bar through forging, machining, assembly, inspection and packing.

R. W. Drayton, Sales Promotion Manager for Snap-On, was the speaker and H. J. Miller, Assistant Works Manager, presided over the subsequent discussion period.

Navy Honors Twin Staters

Springfield, Vt.—Naval Ordnance Development Award pins were recently presented to several Twin States Chapter members on the staff of Jones & Lamson Machine Co., in connection with a company citation awarded by the Navy Department in appreciation of extensive wartime research and development work on an inproved form of gun and powerful high velocity ammunition.

The pins, giving individual recognition to those prominent in the research and development program, were presented by John E. Lovely, Vice-President of Jones & Lamson and a Chapter member, to Joseph Busel, M. P. Holmes, Raymond F. Hronek, Robert S. Jones, George G. Leitch, Floyd J. McArthur, and Ernest R. Seward.

Compares Tool Steels

New Haven, Conn.—With the aid of slides showing graphs and pictures, D. W. Kaufman, Supervising Metallurgist of The Halcomb Works Metallurgical Laboratory, demonstrated to New Haven Chapter members the results of right and wrong steels in toolmaking and their weaknesses.

At the conclusion of Mr. Kaufman's lecture, many took advantage of the opportunity to ask questions. The speaker ably answered all such queries and conducted an informal audience discussion concerning types of steels used for various tools and their heat treatment.

Fathers and Sons Compete In Swimming and Diving

Rockford, Ill. — Father and Son Night was observed by Rockford Chapter, May 1, at the East Rockford High School.

After dinner in the school cafeteria, Chairman Earnest Seborg introduced the East High swimming and diving coach who spoke briefly before presenting his team.

Members and guests then adjourned to the swimming pool where the East High Team put on an exhibition of diving and swimming. Following the exhibition, the fathers and sons enjoyed several water contests.

Urges Self-Loading, Ejecting, Inclinable Press Dies

St. Charles, Ill.—Often neglected or overlooked, the important factor to consider in die design for inclinable presses is safety for the operator.

This fundamental principle was emphasized by J. I. Karash, Plant and Process Engineer, Reliance Electric and Engineering Co., Cleveland, in an address, May 6, before members of Fox River Valley Chapter.

Because of the limitations and possible mechanical failures of such safety devices as the wrist brace, sweep-type guard, Jungen, and Schraeder two-hand air ejector, dies should be designed so that they are self-loading and self-ejecting, Mr. Karash continued.

Should Protect Worker's Hands

These factors should be followed whether unit or strip stock is used. Guards, such as screens, should be placed around the "danger area" so that there will be no possibility of injury to the operator's hands. When a worker has to put his hands in this area to place, remove, hold, or position die work, accidents may occur, he added.

Slides were shown of approved die designs, mechanical safety devices, and the use of knock-out pins. Cam operated ejection stripping pins were recommended by the speaker. Air ejection was also approved, and knock-out pins operating from cam or bottom were reviewed.

Examples were given of the pilot type die for use when secondary operations are performed, and of safety in design of conventional and inverted compound dies. The use of jigger pins where parts of constant size are desired was also shown.

Variable speeds, applied to punch presses in recent years, have achieved greater measures of safety and economy and added utility in general purpose manufacturing, the speaker stated.

V-S drives, he explained, accomplish adjustable speeds with attendant over-all safety. Where danger to the machine can be experienced with back-geared presses and operator safety is minimized with fly-wheel friction drill presses, V-S drives eliminate these problems. Slides showed applications of these units to inclinable presses.

A Past Chairman pin was presented to H. L. Braun by Chairman R.G. Frogness.

Harbaugh Cites Factors In Tool Steel Failure

Toronto, Ont.—Consider the temperature of the steel in the furnace, not the temperature of the furnace itself, said John R. Harbaugh speaking on "Tool Steels and Tool Steel Failures" before 160 members of Toronto Chapter at a dinner meeting May 12 in Malloney's Art Gallery.

Drawing on his practical experience in servicing failure problems, during his association with the Metallurgical Dept. of Jessop Steel Co., Ltd., Mr. Harbaugh described and illustrated many interesting causes of failure in dies, such as thin walls, stamped instead of etched numbers, and holes too close to side walls and too narrowly spaced.

The effect of grinding-checking was detailed and the composition of good tool steel and its relation to long service thoroughly discussed.

Combine Practice With Theory

Explaining theory applied to hardening tool steels, the speaker declared that practical men working with those trained in theory produced the best results. Hardening with the use of a color chart is in his opinion merely guesswork, regardless of results obtained.

Cast-to-shape tool steel came under discussion during the question and answer period, the speaker stating that in many instances it had distinct advantages.

L. M. Jardine, Chapter Chairman, presided over the meeting and Walter Appleton, Past Chairman and member of the House of Delegates, reported on his trip to the Houston meeting.

John W. Lengbridge, First Vice-Chairman, spoke on education and of the efforts being made to bring beneficial knowledge to younger members.

Operations in the manufacture and testing of Whizzer motors are followed by Pontiac members in a tour of the Wilson Foundry & Machine Co. From left: A. J. Rhodes, Chairman; Cash Bond, Program Chairman; C. M. Walter, Secretary; Jack Johnson, Superintendent, Whizzer Division; Thomas Miller, guest; Mills Newman and John Fritcher

North Texas Group Tours McKinley Iron Works

Dallas, Texas—Members of North Texas Chapter were recently conducted through the McKinley Iron and Machine Works, Fort Worth, by DeWitt McKinley, President, who had arranged "pouring time" to coincide with the engineers' visit.

During the dinner meeting held later at the Crown Tool & Machine Co., Mr. McKinley outlined the fundamentals of foundry process for the engineer. The subsequent discussion included results to be expected by the addition of various alloys to pig iron. Of particular interest were the "do's" and "don'ts" to be observed when confronted with the design of cast tooling.

Fred Bates, immediate Past Chairman of the Chapter, related highlights of the Society's convention at Houston. The meeting concluded with the presentation of a diamond-studded Past Chairman pin to Mr. Bates by T. A. Hersh, present incumbent.

Hardening Machine Shown

Syracuse, N.Y. — Development of the new Flamatic hardening machine and its application in the high speed hardening of various types and sizes of gears were depicted in a film shown by Milton M. Garvin of Cincinnati Milling and Grinding Machines, Inc., to Syracuse Chapter members.

Mr. Garvin, who discussed "Researches in Machinability," was the featured speaker at a Chapter meeting May 13 in the Onondaga Hotel.

Moving?

Tell us your new address so THE TOOL ENGINEER can go with you. Mailed under a bulk rate, magazines are not forwarded by the Postoffice Department, but are returned to the sender if they cannot be delivered at the address indicated.

Send your address change to American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

Wilson Co. Visitors See Foundry and Fabricating

Pontiac, Mich. — Richard Wenzell, Plant Manager of Wilson Foundry and Machine Co., was host to more than 40 Pontiac Chapter members and guests for a tour of the plant May 22.

Divided into small groups, the party began the trip in the machine shop, following the sequence of operations in the machining of the Whizzer motor on through block testing.

Proceeding to the fabricating department where the Wilson Easy aluminum garage doors are made, the engineers saw many interesting assembly setups.

Core room operations were followed out to the foundry where cylinder heads for Kaiser-Frazer motors were being cast.

After viewing the charging floor, the visit was concluded with a question and answer session.

Mold Design Important In Plastics Engineering

Rochester, N.Y.—Mold design, construction, most satisfactory steel and its proper heat treatment were emphasized by Edward C. Borro in his lecture, "Tool Engineering for Plastics," delivered May 19 before 75 Rochester Chapter members at a meeting in Rochester Institute of Technology.

A development engineer for Durez Plastic & Chemicals Inc. North Tonawanda, N.Y., Mr. Borro is known throughout the plastics industry as an engineer authority on molds and molding methods.

Edward C. Borro (left), of Durez Plastics and Chemicals, Inc., is congratulated by Milton L. Roessel, Rochester Chairman, for interesting plastics engineering talk

His slide-illustrated talk included an explanation of the basic qualities and differences of plastic materials, machines used in molding and the various types of molds.

After his address Mr. Borro exhibited many plastic articles, explaining their production and answering diversified questions from the floor.

Col. Ward Hamilton of the Ritter Co. and wartime Director of the Bureau of Transportation of the Korean Military Government, gave an after dinner talk on "Railroading in Korea."

* * *

The Chapter's Eighth Annual Bowling Party was held May 9 at Eagles Hall with 275 members and guests participating.

Michael Goy, Chapter photographer, captured the first prize for his high game of 229. A number of attendance prizes were also awarded. Card games were enjoyed and refreshments served during the evening.

Ernest Straw, Entertainment Chairman, and his committee were in charge of the event.

Slides and Samples Show Precision Casting Methods

Milwaukee, Wis.—J. A. Gallaher of the Haynes Stellite Co., Chicago, Ill., presented a comprehensive discussion of "Methods of Precision Casting" before a meeting of Milwaukee Chapter, May 8, in the Elks Club.

Mr. Gallaher's talk was accompanied by slides illustrating castings and their applications. Sample castings were exhibited and questions from the floor were capably answered by the speaker.

Two films, "Pheasant Fever" and "Fire and Water," were shown.

Steel Choice Overrated As Element in Tool Life

Los Angeles, Calif. — Too much emphasis has been placed on the importance of the high speed steel selected, as a factor in the life of a cutting tool, in the opinion of A. H. d'Arcambal, Vice-President-Consulting Metallurgist, Pratt & Whitney Div., Niles-Bement-Pond Co., West Hartford, Conn.

Any of the high speed steels now available, Mr. d'Arcambal declared in a recent address before Los Angeles Chapter, will make a satisfactory tool if the latter is properly designed, correctly heat treated, and provided with an adequate grinding finish.

During 1946, he stated, twice as much carbon tool steel was used than all kinds of high speed steel combined.

The speaker made brief reference to the glass plug gages that received so much publicity early in the war. Carefully conducted tests, he said, indicated that glass gages had only about 25% of the wear life of carbon tool steel gages.

Mr. d'Arcambal dealt at some length with proper heat treatment of carbon and high speed cutting tools and surface treatments.

Numerous tests on various types of cutting tools, he added, disclosed that the life of those receiving sub-zero treatment appeared in no way extended.

Investigation of many "phenomenal" treatments recomended for cutting tools over the past quarter of a century has not justified their extravagant claims for increasing tool life, he observed. The most forward step in this direction, he believes, has been properly applied nitriding treatment.

The speaker illustrated his talk with slides, exhibited a large display of tools and gages, and conducted a lengthy discussion period at the conclusion of his lecture.

Present Lathe Program

Richmond, Ind.—S. A. Brandenburg and S. E. Baer of the Monarch Machine Tool Co., Sidney, Ohio, collaborated in a discussion of "Turning Tools of Industry" as the technical feature of Richmond Chapter's May 13 dinner meeting.

The speakers showed the 67 members and guests present a series of slides illustrating various types of lathes and applications. A color film described the Shapemaster with Keller tracer attachment, the lathe that cuts unusual contours.

Tells Patent Procedure

San Diego, Calif.—Approximately one hundred members and guests of San Diego Chapter heard Judge Everett N. Curtis, prominent local patent attorney, explain "Patents and Steps Necessary for Obtaining a Patent."

Judge Curtis, speaking at a meeting held May 13, also related interesting experiences in this phase of the legal profession.

After the talk, two sound films demonstrating heat treatment of steels were shown.

Claims Broaching Gives Quicker, Better Finish

Indianapolis, Ind.—Accurate, better finish, and the elimination of several milling and shaper operations were claimed as advantages of broaching by Norman H. Iversen, Chief Engineer of Michigan Broach Co., Detroit, in an address, May 1, before Indianapolis Chapter members.

Mr. Iversen briefly reviewed the history of broaching, then discussed its advantages and the fine points of broach design, illustrating with blackboard sketches examples of work difficult to do by other methods.

He concluded his talk with the film, "Broaching in the Plant," which covered most phases of present day broaching operations. These operations varied from flat surface finishing to intricate form cutting.

In a brief business meeting, conducted by Chairman John Horton, a group of students from Purdue University, accompanied by Prof. H. F. Owen, was introduced, receiving the popular applause as the largest group in attendance.

Didn't Try to Get Away

Nope, this isn't a summer vacation idyl, it's three Flint Chapter members with one of the red snappers they pulled from the Gulf of Mexico during the Houston Convention in March. From left: L. A. Kitchen, C. L. Bendle and William Blackwell. The Michigan ASTE'ers, who drove through snowstorm to reach Texas city, had to pinch themselves as they basked in the warm, southern sun, hauling out snappers as fast as they could cast their bait, later having catch for lunch aboard the cruiser.

Coming Meetings

BOSTON—October 30-31, November 1, ASTE Semi-Annual Meeting, Hotel Statler.

BUFFALO-NIAGARA FRONTIER—September 13, Annual Picnic, Walker's Grove, Williamsville, N. Y. Visiting members invited.

CHICAGO—September 24, Dinner and technical session in conjunction with Machine Tool Congress. Furniture Club of America.

CLEVELAND—July 13, Annual Family Basket Picnic. Richmond Country Club.

PONTIAC—August 21, Afternoon Golf Outing at Forrest Hills Country Club. Dinner in the evening.

ST. LOUIS—July 26, Annual Stag Picnic, Tamme's Grove, Fenton, Mo. Diversified sports activities, valuable prizes.

GADGETS

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

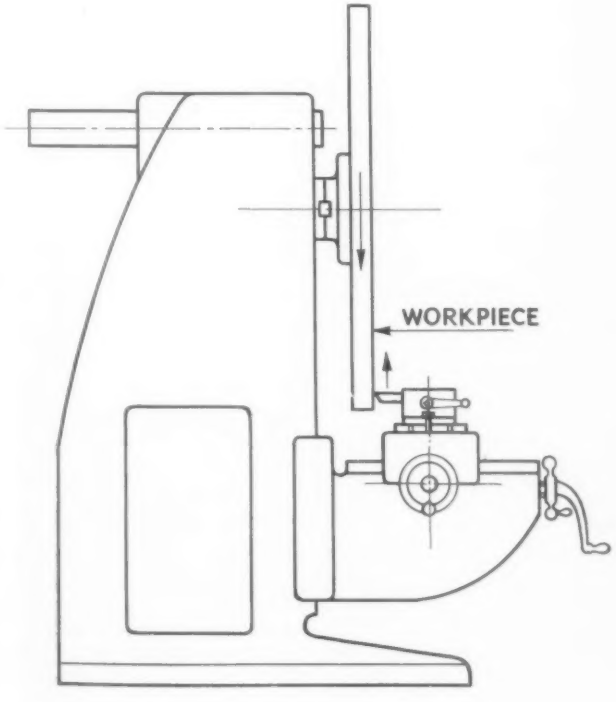
Lathe Work on Miller

THE "KINK" SHOWN, which relates to the use of a milling machine for turning, facing or boring large diameter work, is not claimed to be new. It has been used in jobbing shops, where a wide diversity of work and limited equipment must be bridged with ingenuity, over a period of many years. But new or old, the idea may well be stored in the mental files, to be pulled when an emergency job is quite outside the range of available lathes.

The work may be chucked, screwed to or clamped on a faceplate, depending on its nature and whether it is provided with a hub or with an open hole. The tool is gripped in the milling machine vise, and the table lowered until the knee clears the swing of the workpiece. The tool should have as little overhang as possible, to avoid chatter and spring.

While it is desirable, it is not essential that the tool be at center line of the spindle—that is, unless it is necessary to face close to the center. In such case the vise may be blocked up. For large diameters, however, the tool may be below center, with the table feeding horizontally. Or, one may start below the O.D. of the workpiece and feed upward, with the tool on the vertical centerline, as shown in the illustration.

Naturally, the larger the diameter of the work, the more power will be required to turn the work against the tool. In such cases one may have to use the back gears, both to obtain power and to reduce surface speed. In any event, the rpm will have to be progressively reduced or increased as one moves in toward the center or away from it. Here, however, one cautionary note may be added: While it is not essential that the tool be on center, in many instances, it is necessary that it be tipped so that the top face is radial, as in conventional turning. This is especially necessary when performing boring operations.



"Stethoscope" for Engineers

ORDINARILY, one associates the stethoscope with the medical profession although, over a period of time, variations have been employed in automotive service stations to locate noises in engines. Now, the doctor's technique has invaded industry, as shown by the use of a resonance tube to determine ailments in steam turbines. The "doctor," in this case, is William Trumpler, design engineer at the Steam Division of Westinghouse Electric Corporation.

In normal operation, steam turbines have little characteristic noise despite that the tips of the blades may whirl at supersonic speed. When something is wrong, however, the tip-off is a hum, wheeze, or some other unusual sound. This may be caused by several things, ranging from a worn bearing to a stretched blade, and the trouble can be located by the use of the resonance tube, abetted by the engineer's experience.

The resonance tube itself is simply a hollow plunger fitted into a sleeve, and may vary in size from 6 to 60 inches. By extending or retracting the plunger, the tester "tunes in" to the sound frequency much after the manner of tuning a radio to the frequency of a broadcasting station. For any one position, only one frequency can be heard; thus, by measuring the length of the tube at the position at which the noise is heard, the frequency is determined. Then, by dividing the known velocity of sound by the frequency, the wave-length of the noise is established. This may be charted for future reference. Broadly applicable to other uses, the "stethoscope" described promises to be a time and money saver throughout industry since minor troubles in machines may be located before serious breakdowns result.

BULLETINS AND TRADE LITERATURE

Items briefed herein have been carefully selected for their interest and application. Unless otherwise stated, all are available, free, from the stated sources.

GENERAL ELECTRIC, Schenectady, offers *Bulletin GEA-1448B*, a seven-page booklet describing automatic supervisory equipment for remote control of power apparatus. *Bulletin GET-1293* is a valuable 23-page booklet which explains the purpose and use of electrical diagrams supplied with switchgear equipment. Included is a thorough review of the basic symbols and conventions used in electric wiring diagrams.

A new 16-page *Catalog Supplement GT-199*, available from CARBOLOY CO., INC., Detroit, incorporates several other recent supplements and can be inserted in general Tool Catalog GT-175R. Among the new products listed in the supplement is the expanded line of standard solid carbide boring tools and the new standard line of solid carbide boring bars.

Controlled-Air Power, a new bulletin released by THE BELLOWS CO., 798 N. Main St., Akron, describes the many devices which permit repetitive operations to be powered by air rather than manually. The use of these devices means higher production, less fatigue of workers, and less scrap through reduction of the "human element." Case histories on successful applications of Bellows equipment are written up and illustrated in *Foto Facts File* sheets, a number of which are available.

Norbide Abrasive is a folder issued by the NORTON COMPANY, Worcester 6, Mass., describing Norton Boron Carbide, an extremely hard abrasive especially adapted for lapping of cemented carbide tools and dies, cutting and polishing wire drawing dies, and cutting and polishing gems. Another booklet available from this company is *Heavy Duty Refractories*, with 21 pages filled, principally, with basic information on the nature and purposes of the many refractories, and their proper selection. Among the features of the booklet are such helps as a temperature conversion chart, table of atomic weights, table of conversion factors, table of melting points of metallic elements, thermal expansion graph, thermal conductivity graph, etc. A comparative table lists the characteristics of 15 different refractories. Considerable space, of course, is given to applications of the Norton products—Alundum and Crystalon.

MACHINERY LUBRICANTS, INC., 31 St. James Ave., Boston 16, Mass., is offering a 6-page illustrated brochure on the characteristics and application of *Silver-Chip*, a synthetic non-petroleum cutting oil developed and marketed by this recently-formed company.

TABER INSTRUMENT CORP'N, 111-TE Goundry St., No. Tonawanda, N. Y., is now distributing a 12-page bulletin describing and illustrating the company's complete line of *Taber Abrasive Accessories*—attachments, parts and supplies — specially developed for use with the Taber Precision Wear Tester. These new and improved aids are designed to provide easier, faster, more accurate abrasion-resistance testing of electroplated finishes, organic coatings, plastics, rubber, leather, textiles, paper and paperboard.

The *Third Edition of Catalog CD*, issued by the WALES-STRIPPIT CORPORATION, North Tonawanda, N. Y., illustrates and describes the line of Wales Type "CD" Hole-Punching Units for the multiple punching of sheet metal up to 1/8" thick.

Bulletin 216, issued by HAMMOND MACHINERY BUILDERS INC., Kalamazoo, Michigan, announces the new Hammond No. 7 Carbide Tool Grinder, which has many desirable features.

EX-CELL-O CORPORATION, Detroit 6, Mich., publishes *Ex-Cell-O Tool Tips*, an attractive periodical bulletin presenting the latest information on Ex-Cell-O products. Also included are descriptions of unusual applications of this equipment.

Bulletin CJ has been announced by WALES-STRIPPIT CORP'N, No. Tonawanda, N. Y. This 8-page folder describes and illustrates the Wales Type "CJ" Hole Punching Units, used in a stamping press for punching holes in mild steel up to 1/4" thick. Advantages of these units include time saved in die setting—the only purpose of the press ram is to depress the punch in each unit; the punch and die contained in the same unit are always in perfect alignment; and while one pattern is operating, another can be set up away from the press. Angles, channels, and sheet metal can all be handled by this method.

Electrolimit Mill Gages, Catalog 489, and *Air-O-Limit Comparators, Catalog 487*, were recently released by the PRATT & WHITNEY DIVISION, Niles-Bement-Pond Co., West Hartford 1, Conn. *Catalog 489* illustrates the Electrolimit Continuous Gages for measuring sheet thickness on continuous cold rolling mills and continuous shearing lines. The various power, recording, and control accessories are also described. Other Electrolimit Gages included are those for determining rolling mill pressures, sheet thickness of non-metallic materials, and sheet thickness of rolling foil mills. *Catalog 487* covers the P & W line of Air-O-Limit Comparators, instruments which employ air as a gaging medium for checking and inspecting production parts.

Magnetic Materials, offered by the ALLEGHENY LUDLUM STEEL CORP'N, 2020 Oliver Bldg., Pittsburgh, is a 32-page brochure on the basic functions of magnetic ore materials for the electrical industry. Unique, full-color graphic illustrations and simply worded but precise text make the complete story valuable to both the initiate and the engineer with previous knowledge of the subject.

BULLARD COMPANY, Bridgeport, Conn., has a new and interesting booklet entitled *Proved Interchangeability Without Jigs*. This piece traces the development of the Man-Au-Trol Spacer, which is designed to eliminate the need of drill jigs. Illustrated are samples of parts made without jigs and testimonial letters from manufacturers who have successfully used the Man-Au-Trol Spacer. Also available is their regular advertising circular on the *Bullard Man-Au-Trol Spacer*.

KENNAMETAL INC., Latrobe Pa., in their new *Catalog 47*, announces a number of additions to their extensive line of cemented carbide cutting tools—clamped-in solid round tools for mass production operations, internal radius tools and blanks for round-cornering, grooving tools with clamped-in blades for multiple blade jobs, Axial Face Kennamill milling cutters, etc. This catalog is exceptionally well planned for easy selection of the proper tool. Several pages are devoted to instructions on the selection, ordering, and care of Kennametal products.

W. C. ROBINETTE CO., 802 Fair Oaks Ave., So. Pasadena, Calif., has a new *Bulletin H-26* delineating features of their package robot (servomechanism) control called Motron, for such uses as tracer controlled mechanisms for oxy-acetylene cutting or lathe duplicators, as well as automatic weighing.

HARDINGE BROTHERS, INC., Elmira, N. Y., has issued a new bulletin on their *Style "B" Master Feed Fingers and Interchangeable Pads* for automatic screw machines. The Master Feed Finger allows continual savings through the use of comparatively inexpensive pads for various sizes of round, hexagon, and square stock up to 2 5/8". Pads are available in hardened steel, nickel, cast iron, and bronze to suit all materials and classes of screw machine work. A 28-page pamphlet is available on the new *Hardinge Multi-Operation Chucking Machine*, which features economy, effected by the use of standard tool bits. All operations—diameter, shoulders, and end finishing and precision thread cutting are achieved in one setting. Blueprints of eight typical workpieces and photographs of the required setups illustrate the versatility of these machines.

MORSE TWIST DRILL & MACHINE CO., New Bedford, Mass., announces two new circulars — one on *Morse Hi-Helix End Mills* used at high speeds and feeds for slotting, channeling, profiling, and general milling, the other on *Morse Short Standard Drills* especially adapted for screw machine work and also usable in portable electric drills.

Bulletin No. 302, issued by THE MONARCH MACHINE TOOL COMPANY, Sidney, Ohio, covers in detail the design and construction features of the Model EE Toolmaker's Lathe. Standard and optional features of this 10-inch precision machine are fully described in 24 pages of text and clear functional illustrations.

BEHR-MANNING, Troy, N. Y., manufacturers of cut-to-length rayon flock, offer a new 10-page booklet on *Flock and Flock Finishing*. Containing 24 sample color swatches, the new booklet describes the adhesives and flocks and their application on various surfaces, and lists the numerous decorative and functional uses for flock.

ROBBINS ENGINEERING CO., 318 Midland Ave., Detroit 3, offers a new catalog on the *Robbins No. 3 Drillmatic*, a standardized machine for special purpose drilling, reaming, tapping, and boring operations.

GOOD READING

A Guide to Significant Books and Articles of Interest in the Trade Press

Copies are still available of **ABRASIVES & GRINDING WHEELS,** a 108-page handbook by the *Norton Company,* Worcester 6, Mass., which introduces its subject by asking this fundamental question: "Do you know that grinding is the cutting action of thousands of abrasive grains on the face of the grinding wheel and that the grains actually *cut* chips out of the work?" It proceeds from such basic grinding information to "cover the field," so to speak, and includes 12 pages of definitions. There is also a discussion of such subjects as grain size, grades, structure, and the six general types of bonds—vitrified, silicate, shellac, resinoid, rubber and magnesite.

IRON ORE AND THE STEEL INDUSTRY, a speech by C. M. White, President of Republic Steel Corp'n, which he delivered before the annual meeting of the *American Institute of Min'g & Metallurgical Eng'rs,* N. Y. 18, sounds another warning concerning the ultimate depletion of our rapidly dwindling iron ore reserves. Quoting from his speech, now printed in booklet form, Mr. White puts it this way: "The American steel industry," he explains, "destined to be the greatest supplier of steel for the world market for many years, faces dire shortages of actual iron ore within a period too short to be comfortable."

The world reserve of actual ores is estimated at about 16.2 billion tons of metal, and although the United States has 10.5 per cent of that total, Mr. White feels that "we must install concentrating plants and use the magnetic taconite of the Mesabi Range and the magnetic ores of New York, New Jersey and Pennsylvania." He continues by explaining that "methods for the concentration of the low-grade hematite ores are being studied intensively, but to my knowledge practices have not yet been developed to a point where a commercially attractive finished product can be produced."

Striking a more optimistic tone, Mr. White turned to the past to point out that whenever a great problem has arisen, engineers and industry in general have usually found some sort of a solution. He somehow feels this shall also hold true in regards to the present iron ore situation.

"Hence, there is every reason," he concludes, "to believe that when the abundant low-grade iron ores become the principal sources on which the world must depend for its iron and steel supplies, engineering achievements will rapidly overcome the present handicaps to the utilization of these deposits."

THE FOREMAN'S PLACE IN MANAGEMENT, by Charles Copeland Smith, emphasizes the growing importance of the part foreman in management-labor relations. Through a careful recording of historical events, the author tends to show that executive management must work for better co-operation with supervisory management or else management-labor relations will suffer.

The book at once challenges executive management and provokes thought among supervisors and foremen. The author shows the conditions which give rise to the organization of foremen, and the advantages claimed therefrom, and also points out the dangers and pitfalls that may accompany such organization. Available from *Harper & Brothers Publishers,* New York, N. Y., at $2.00 per copy.

PRECISION HOLE LOCATION, a 448-page book on toolmaking practices, published by *Moore Special Tool Co., Inc.,* Bridgeport, Conn., (previously reviewed on p. 44, January '47 issue, *The Tool Engineer*) has been selected from among 700 entries as one of the "Fifty Books of the Year 1946" by the American Institute of the Graphic Arts, New York City.

The books were judged on the basis of good bookmaking techniques. The printer of the book, the photographer, and artist were commended, as was *Fred Wittner Advertising* of New York, the Moore Company's agency, which supervised the design, organization of material and production.

Ranking high in importance to industry, and of special interest to tool engineers and all others having to do with metal processing, is the published report—**MILLING WITH CARBIDES**—prepared by the Technical Committee on Carbide Milling Cutters of the *Metal Cutting Tool Institute.*

The Committee, of which the well known ASTEer Carl J. Oxford, chief engineer of the National Twist Drill Company, is chairman, includes ASTE members Edward D. Wiard, Gorham Tool Company, Joseph Dorjath, Goddard & Goddard Company, Leo W. Reuland, Barker-Colman Company, Carl W. Wilke, The Standard Tool Company; also, Fred Bohle of the Illinois Tool Works.

The 41-page report is divided into seven sections, as follows: General Considerations in Applying Carbides to Milling; Grades of Carbide and Their Application to Milling; Nomenclature for Carbide Milling Cutters; Machine Tools and Fixtures for Carbide Milling; Carbide Milling Cutter Design; Operating Techniques for Carbide Milling; and Sharpening and Care of Carbide Milling Cutters.

The section on Grades of Carbides is of particular value to the engineer for selection of the proper tool for a specific job. The various work materials are tabled, and the carbide group specified for the type of cut to be made in each material. The carbide groups are further broken down by hardness, and the various trade-names which fall under each classification are given. A long list of carbide trade-names is included, with the principal characteristics and the manufacturer given in each case.

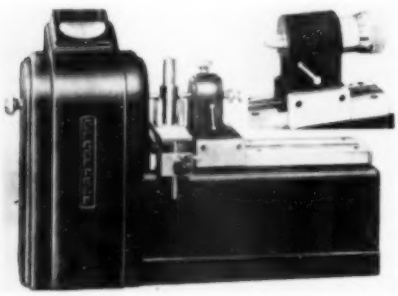
With this report, the Committee has taken a long step toward attaining its final objective—i.e., the standardization of carbide milling cutter design. To this end, the section on Nomenclature, recommended by the American Standards Association, and the section on Carbide Milling Cutter Design, are important contributions. Preceding the section on design is one on the requirements of machine tools and fixtures used for carbide milling. The section on Design then takes up job analysis and the details of design and its basic requirements.

Of interest to the men responsible for the actual performance of the work are the sections on Operating Techniques, which includes information on the selection of feeds and speeds and the permissable cutter runouts, and Sharpening and Care of Carbide Milling Cutters. Both of these sections contribute materially toward the successful use of carbide tools. This comprehensive and valuable work is available, at $1.00 per copy, from the Metal Cutting Tool Institute, 410 Asylum Street, Hartford 3, Conn.

TOOLS OF TODAY

New External Comparator

A new external COMPARATOR, for inspection and gage laboratory use, is announced by the *Sheffield Corporation*, Dayton, Ohio. The instrument has a wide range of adjustability — 3½" in height and 0 to 10½" in length—which permits quick, accurate measurement of rectangular, threaded or cylindrical parts, tapped or straight, to millionths of an inch.

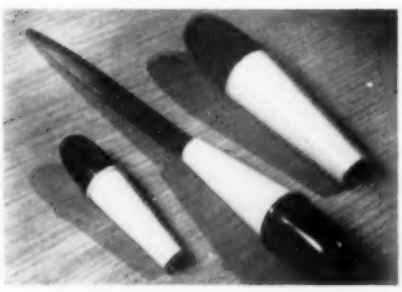


Flexibility allows two methods of setup and operation. With the micrometer tailstock, readings of .0001" may be had from the calibrated barrel, without resort to gage blocks or masters on applications below 1 inch. If full accuracy is desired, the tailstock may be set at 0, gage blocks used for setup, and readings in millionths may be had from the Electrigage head. This indicating unit may be obtained in amplifications of 100-1, 2500-1 or 5000-1.

The table, which is adjustable vertically from 0—or center line of gaging anvils—to 3½", and fastened by a locking screw, may be positioned horizontally within a range of 10½"; and, if necessary, it can be easily removed.

T-7-1

Plastic File Handles



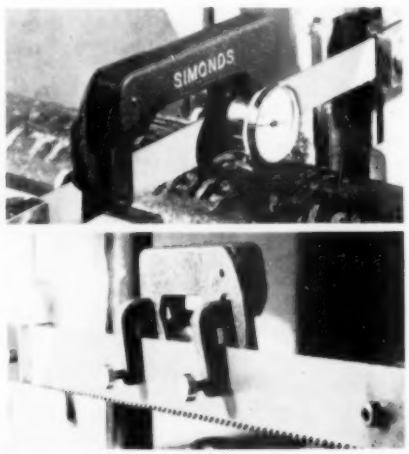
FILE HANDLES of molded plastic, by *Arnold Brilhart, Ltd.*, New York, are tough, light in weight, smooth to the hands, and because of their distinctive coloring, easily distinguished among a miscellany of tools.

Made from Celanese Celcon, a product of the Celanese Corp'n of America, 180 Madison Ave., New York 16, the handles have excellent dimensional stability and will not loosen from the file.

T-7-2

Hacksaw Tension Device

A new device, called the SIMOMETER, accurately measures applied tension on power hacksaw blades and indicates the correct amount for maximum cutting efficiency. A product of *Simonds Saw and Steel Co.*, Fitchburg, Mass., the device can be attached directly to the blade to be tested.



As tension is applied, a pointer on a simplified, easy-to-read dial indicates correct tension. When the proper tension is attained, the instrument is removed and any job of sawing may then be started with straighter cuts and with the assurance of a considerably longer life of saw blades.

T-7-3

Quick Acting Vise

A QUICK ACTING VISE, now in production, is a new addition to the line of bench tools by the *Reypo Corporation*, 9900 Lincoln Blvd., Los Angeles 45, Calif. A versatile tool and designed for precision work, the vise incorporates an accurately machined dovetail slide, with adjustable gibs to compensate for wear and to prevent wobble. The rear jaw can be set in two positions, and both jaws fitted with replaceable inserts which may be of plastic or soft metal.

Quick action is had by pushing the barrel and screw assembly until the jaws contact the work, when clamping is effected by a partial turn of the screw.

T-7-4

New Filter Press

A new vertical stack FILTER PRESS of cast iron construction that combines plate and frame in one casting, to permit easy removal of cakes, has been developed by the *Youngstown Miller Co.*, subsidiary of Walter Kidde & Co., Inc., of Belleville, N. J. The new press is suitable for the filtration of many liquids, including alkyd resins, solvents, essential oils, cutting fluids and coolants.

Unique combination of plate and frame enables quick, easy cleaning and removal of cakes through an individual latching arrangement of each frame. Starting with the top frame, each section is individually latched in an elevated position to permit the filter paper and cake to be pulled forward out of the press.

T-7-5

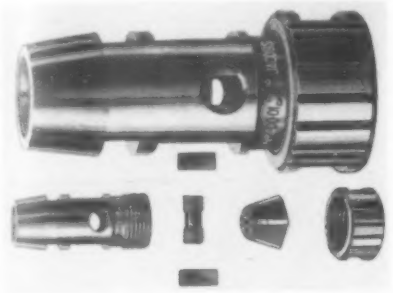
Knee Type Tool Bits

A new line of KENNAMETAL TOOL BITS, for use in knee attachments on Turret lathes, has been developed by *Kennametal, Inc.*, Latrobe, Pa. They are now available in a range of K-M cemented carbide compositions for machining steel, cast iron and non-ferrous materials.

T-7-6

Rubber-flex Tap Chuck

Designed particularly for tapping heads and tapping machines, a new small diameter RUBBER-FLEX TAP CHUCK, by *The Jacobs Manufacturing Co.*, Hartford, Conn., combines extreme lightness and small diameter to reduce torsional inertia and tap breakage, particularly in bottom tapping. It also allows quicker reversing and higher spindle speeds.



The Rubber-Flex Collet consists of several hardened steel jaws bonded into a synthetic rubber body, which resists deterioration from heat, coolants, or cutting compounds. As the cap of the chuck is screwed onto the body, the collet is forced into a ground conical bore in the chuck body until it has a true and rigid grip on the tap shank.

Two floating jaws, of heat treated alloy steel, provide a positive drive on the tap square and maintain a firm grip on the square even though it may be off center. Tap changing is done simply and quickly, and only three chucks are needed to cover all taps ranging from No. 0 macine screw tap to $\frac{5}{8}$" hand tap.

T-7-7

Tangent Chaser Die Heads

In line with current trends to expedite production are the new TANGENT CHASER DIE HEADS developed by *Murchey Machine and Tool Co.*, Detroit, manufacturers of collapsible taps and self-opening die heads.

A feature of the new head is the quick and simple removal and replacement of chasers and chaser holding blocks, usually without removing the tool from the machine; in addition, the operator is able to replace blocks and chasers previously set to exact location in a micrometer setting fixture. Because of this, one die head with extra chasers and blocks can take the place of two or more complete setups and therefore reduces machine down time.

These die heads are furnished in revolving and stationary type. Shown is the type "TRB," a rotating yoke-operated tool for use on automatic screw machines, drill presses, or any machine where the tool revolves.

T-7-8

New Federal Hole Gage

Model 1204 SMALL HOLE GAGE, by *Federal Products Corporation*, 1144 Eddy St., Providence, R. I., is a self-centralizing Indicator Gage which shows size variations in tenths of thousandths and provides for thorough inspection of I.D.'s between .250" and .500".

The spring-centralizing design, together with the precise measuring contacts and motion transfer units, locate themselves in the hole and show the true diameter reading with a high degree of accuracy. The gage employs fourteen interchangeable extensions to cover the full range from $\frac{1}{4}$" to $\frac{1}{2}$", explores any hole within its range to a maximum depth of $2\frac{1}{4}$", reveals diameter, roundness, taper, bellmouth and other hole inaccuracies.

Model 1204, which is packaged in a plush-lined wooden case and comes complete with adjusting wrenches and required extensions, offers several advantages for checking holes in the $\frac{1}{4}$" to $\frac{1}{2}$" size range. It may be used as a single-purpose inspection tool, or for checking a variety of sizes. It shows exactly how much a dimension varies, not merely whether it's in or out of tolerance, while point to point contact reveals any small area imperfections in a hole.

T-7-9

New Machine Tool

A new heavy duty multiple spindle TWO-HEAD BORING MACHINE, developed by the *Bristol Machine Tool Company*, Bristol, Pa., promises marked economies on production boring work. Originally built for machining connecting rods for refrigeration compressors, the machine consistently produced at the rate of one complete rod every 48 seconds.

The operation sequences were as follows: Rough bore 2.490" and drill .4218 hole. Then finish ream 2.500 plus .0005" minus .000"; ream .4375" and, in addition, drill No. 21 hole for wrist pin clamp. Dimension between bores was held 4.125 plus and minus .001". Complete information is available from the maker, who is currently offering 90 days delivery.

T-7-10

Carbide Tool Grinder

The Bradford Machine Tool Company, Cincinnati 4, Ohio, is now offering Model 260 CARBIDE TOOL GRINDER. Mounted on left is a regular grinder for rough work; at right side, is a cup wheel mounted for accurate finish grinding. Work table is precision machined and is adjustable to desired angles and to height and wheel wear. The Grinder is equipped with eye shield, tool tray, water pot, and guards with exhaust connections. Slope front is designed for maximum foot clearance. The motor (220-440, 550 volts, 2 or 3 phase, 50 or 60 cycle) is totally enclosed to N.E.M.A. specifications.

T-7-11

New Lapping Machine

Size Control Company, Division of American Gage & Machine Co., 2500 Washington Blvd., Chicago 12, has developed a 2-stage LAPPING MACHINE on which both rough and fine (or finished) lapping operations can be performed on small,high precision cylindrical parts. The design incorporates the basic features of the Size Control centerless lapping machines previously introduced in *The Tool Engineer*. With this machine, one part or many can be lapped without need of special setups or resort to accessory lapping appliances. Accuracy is claimed to be within 2 microinches.

T-7-12

Ames Truetest Indicator

A new UNIVERSAL INDICATOR, by the *B. C. Ames Company,* Waltham 54, Mass., incorporates among novel features an automatic reversible action that eliminates the tripping of a latch when changing from "over" to "under" work. As another time saving feature, the Indicator always moves in the same (clockwise) direction whether the top or the bottom contact point is in use.

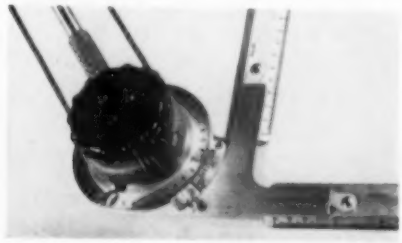
Called the Ames Truetest Indicator, the instrument embodies the usual Ames ruggedness which, together with the patented bezel wire, dial and unbreakable crystal construction, provides a high degree of protection to the sensitivity and accuracy of this extremely flexible indicator. The contact finger is easily swivelled to any desired angle and maintained without a slippage. The contact itself is threaded and cannot drop out. Two contacts are furnished—.100" and .031" diameter—also, two support bars, one ¼" wide for tool post work and the other ⅛" for height gage work.

The Truetest is available in two models—No. 1, reading in .0005" with 0-15-0 dial, and No. 2, reading in .0001" with 0-4-0 dial. Outside dimensions are identical and the contacts are all interchangeable. The instrument, which is a time saver on varied types of precision work, is packed in a handy, plastic box which provides safe and convenient storage when not in use.

T-7-13

Vemco Drafting Machine

V. & E. Manufacturing Company, 758 Fair Oaks Ave., Pasadena, Calif., offers several notable improvements in its 1947 VEMCO DRAFTING MACHINES. Steel covers for protection of the bands from dust and dirt are now standard equipment and enhance appearance without interfering with the flexibility of the drafting head. Braking action is improved, and metal brake plates replace plastic plates. Metal parts have either a metallic blue-green finish, which lessens eye strain, or are tarnish-proof satin finished. Catalog available.



T-7-14

New Contour Sander

Designed for finishing and sanding of any irregular surface or edge, a heavy duty industrial model CONTOUR SANDER has been introduced by the *Sand-O-Flex Corporation,* 4373 Melrose Ave., Los Angeles 27, Calif.

The tool, known as Model 650C, has 12 brush-backed abrasive strips which can be used on any rotating shaft, being fed out as needed from an internal cartridge. As the tool is rotated, the strips are forced into, around and over any surface or contour, and provide fast action for sanding and finishing operations.

T-7-15

Versatile Bench Filer

The *DoAll Company,* 254 No. Laurel Ave., Des Plaines, Ill., announces a new and larger Model FH-10 DoAll Precision Bench FILING MACHINE for filing, sawing and honing operations. As in the smaller FH-1 Model, this machine incorporates the patented universal joint clamp which, used in connection with a file setting square, assures a 100% vertical file position despite warped or twisted file shanks. An overarm backup roller supports the tools.

Available for immediate delivery, this unit has a tilting table 10⅜", 1½" stroke, a file shank capacity of ⅛" to ⅜" and is powered by a ¼ hp, 110 volt, 1724 rpm., AC motor which provides approximately 350 strokes per minute.

The tools are actuated by a scotch yoke mechanism, running in an oil bath, with the correct oil level shown at all times through a window in the housing. Vertical shaft bearings are adjusted by locking thumb screws on outside of housing. A neoprene bellows keeps chips out of mechanism and provides an intermittent air jet through a flexible tube to remove chips at point of work.

T-7-16

New Welders By Sheffield

While originally developed by the Western Electric Company, a newly designed automatic contact point or disc WELDING MACHINE has been further redesigned and improved by the *Sheffield Corp'n,* Dayton, Ohio, who now manufactures under license agreement.

With either type of machine (contact point or disc) the accurate and secure placement of electrical contact material on contact springs can be accomplished at a production of 1200 to 2400 contacts per hour. The spring is loaded in a suitable holding fixture and moves through a series of stages. In the case of the disc machine, it involves the punching of the disc and placing it at the proper location on the spring, welding the two securely together, and the final operation of shaping the contact to the required flatness or contour.

T-7-17

New Oil Filter

Featuring a compact, replaceable cartridge with a number of perforated cellulose discs that provide an exceedingly large filtering area, a new OIL FILTER for lubricating oils, fuel oils, cutting compounds, and hydraulic fluids is available for immediate delivery from the *Youngstown Miller Co.,* subsidiary of Walter Kidde & Co., Inc., Belleville, N. J.

This new replaceable filter cartridge—mounted inside a drawn steel shell capable of withstanding high pressures—is piped for in-and-out flow to form a streamlined high liquid velocity unit.

T-7-18

New Gravity Drop Hammer

Chambersburg Engineering Co., Chambersburg, Pa., announces a new GRAVITY DROP HAMMER — named the Ceco-Drop — that is claimed to outproduce any existing tool of its type. Unlike the conventional board drop hammer, no boards are employed, or other form of friction lift; instead, air or steam is used to raise the ram while a simple, ingenious

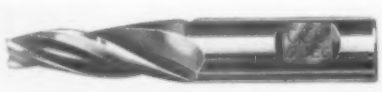
clamp holds the ram and rod at the top of the stroke. Release is by means of an air valve actuated by the operator's foot treadle.

Because of its speed, metal is forged at higher temperatures, forgings are better matched through use of parallel, integral guides (electronically hardened), heavier frames, and a low center of gravity which insures against movement and vibration.

T-7-19

Tapered Spiral Cutters

A new standard line of H.S.S. TAPERED SPIRAL CUTTERS, offered by *Cadillac Cutter Co.*, 1613 Eastern Ave., S.E., Grand Rapids 7, Michigan, is particularly suited to machining dies, molds and patterns where draft or clearance is required. Cutters run from ½° to 7° taper per side, ½" to 3½" flutes, and small end diameters from 3/32" to ½".

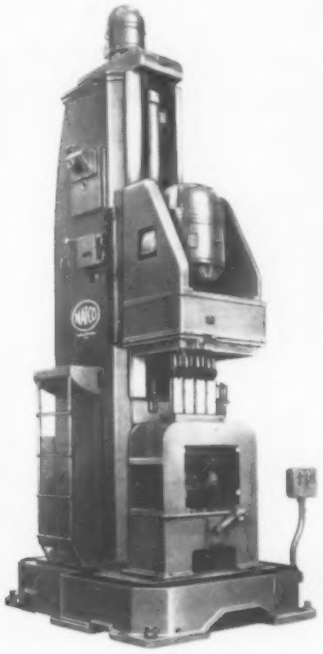


These end-cutting tools have straight shank with flats for easy insertion in set screw holders, uniform hook rake, R. H. cut, R. H. spiral, and three flutes for minimized chatter and added strength. Radius or ball ends can be furnished to order specifications.

T-7-20

New Natco Holesteel

A new NATCO HOLESTEEL vertical machine, designed for cylinder boring of replaceable sleeve liners, is arranged with hydraulic feed and a fixed center gear driven head containing four spindles. The part worked on, in this application, is a cylinder and crankcase of cast iron, and the production rate is 28 parts per hour. The machine is arranged to combination rough and finish bore four cylinder bores to 3.781" diameter and counterbore to 4.001" diameter. The machine utilizes jump feed to combination rough and finish bore lower holes to 3.719" diameter and chamfer 15° x ¼" deep. Further details on this Natco machine application may be obtained by writing Dept. 56, *National Automatic Tool Co., Inc.*, Richmond, Indiana.



T-7-21

Soldering Iron Support

The VERTI-MOUNT, by *Multi-Products Tool Co.*, 123 Sussex Ave., Newark, N. J., has been developed as a bench support for any size portable Eject-O-Matic automatic feed soldering iron. Being foot-operated, both hands are left free to hold work. The soldering iron is held firmly to the vertical column, but can also be very quickly dismounted for hand operation.

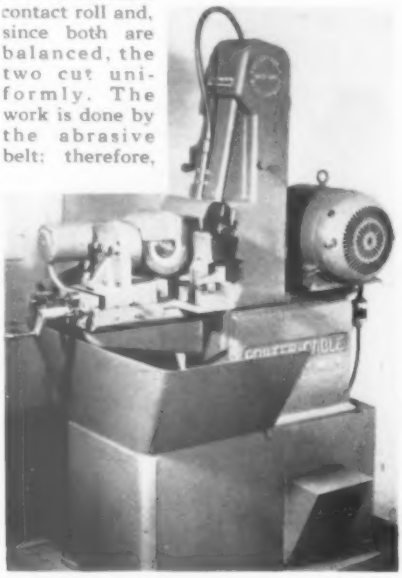
Operation of the foot-treadle lowers the soldering iron, clamping the work firmly and preheating it to proper soldering temperature. As the downward stroke is completed, a fixed roller stop trips the Eject-O-Matic trigger and ejects a prescribed amount of solder.

T-7-22

New Centerless Grinder

A centerless WET BELT GRINDER, said to offer several distinct advantages, is the latest addition to the line of wet belt machines manufactured by *Porter-Cable Machine Co.*, Syracuse, N. Y.

An endless abrasive belt operates over a resilient contact roll and, since both are balanced, the two cut uniformly. The work is done by the abrasive belt; therefore,



the contact roll which backs up the abrasive belt and thus remains flat across and square at the corners gets little, if any wear. Its diameter remains constant, a condition that eliminates much truing and balancing.

This new centerless grinder handles a variety of operations, is adapted for through work of short pieces, ¾" to 2 ft. lengths; and longer parts may be ground with proper supports. Diameters handled range from 3/32" to 2¼". All necessary safety features are incorporated in this latest centerless.

T-7-23

Improved Buffing Lathe

The *Standard Electrical Tool Co.*, 2499 River Road, Cincinnati 4, Ohio, announces a redesigned 2 h.p. and 3 h.p. Infinitely Variable Speed BUFFING and POLISHING MACHINE.

The enclosed ball bearing motor on the model shown, is on an adjustable base attached to the back of the pedestal, with power transmission through belted drive. Any spindle speed between 1500 and 3000 r.p.m. is instantly available by merely turning the "Speedial" control.

T-7-24

New Polishing Lathe

The first model in a new line of "Washed Air" POLISHING & BUFFING LATHES has been introduced by *Ralph Hockman & Company*, exclusive national distributors, Newark, N. J. This first machine—Model 400— is simplified and compact, requiring minimum floor space and servicing. The same 1725 rpm motor operates both spindles and dust collectors.

It is equipped with twin tapered spindles which, if desired, may be replaced with straight spindles. The spindles run on standard ball bearings fitted into a polishing head of cast aluminum.

A feature of the machine is a built-in dust collector system in which the dust-ladened air, drawn from the working area, is cleansed by being passed through a fabric dust-bag immersed in water. This system permits salvaging a high amount of valuable pulverized matter.

T-7-25

New Inside Micrometer

A new type of inside micrometer—the "RIMAT"—announced by the *Richards Machine Tool Company*, 124 South Isabel St., Glendale 5, Calif., is designed to meet the demand for the measurement of internal dimensions with accuracy and without time waste or possibility of error. Reading is direct.

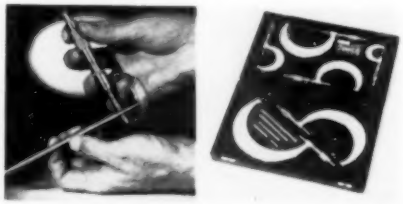
These tools save time when machining back of a flange, or when boring recesses that have to be kept to close limits. In such instances, the tool can be inserted, the measurement taken, the measuring pins retracted and the tool withdrawn, a feature to be appreciated by all toolmakers.

Incorporating standard micrometer accuracy and refinements, the Rimat Inside Micrometers have a range of 1" and are available in two sizes—the 3" to 4" size, with extra measuring rods up to 6", and the 6" size with extra measuring rods up to 12". Special sizes made on order.

T-7-26

Improved Tubular Mikes

Structural weight has been cut up to 50% in the new TUMICO MICROMETERS, manufactured by the *Tubular Micrometer Company*, St. James, Minn. The weight factor alone offers greater freedom of movement with lighter "touch" and "feel," thus improving overall precision measuring.



The Tumico line includes the conventional type ranging from 0" to 24"; the blade type for measuring narrow depths furnished in sizes from 0" to 4½", and the roller mill tubular micrometers to be had with a 3" or 6" throat depth. Bow type micrometers with interchangeable mandrels provide OD measurement from 0" to 96", while internal bores from 6" to 106" may be easily measured. Also, to simplify internal bore measurements, an over-the-bar type tubular micrometer has been designed in ranges from 8" to 28".

Any of the various types may be purchased individually or in sets, depending upon user requirements, and may be furnished with added features such as ratchet stops, ball bearing cam action lock rings, readings by ten-thousandths and radius ground anvils.

T-7-27

New Pyrometric Controller

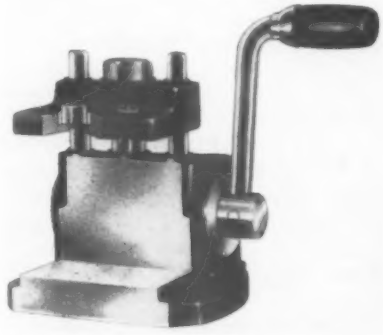
The new Veritron Electronic PYROMETRIC CONTROLLER, announced by the *Taco West Corp'n* of 2620 South Park Avenue, Chicago, is a two position electronic controller offering many unique features including a new electronic circuit, ultra compact design and simplified operation. It is specially suited for direct installation on industrial furnaces and plastic molding machines.

T-7-28

In operation, the control pointer is set at the desired temperature and control is immediately established within an exceptionally narrow temperature range. This is accomplished without using high frequency oscillator systems, capacitance systems or mechanical clamping mechanisms. Measuring system and electronic mechanism are separately housed in sealed units that plug in to the instrument case. The complete instrument measures only 7⅛" by 5¾" by 5¼", and may be either flush or surface mounted. A full five-inch mirrored combination scale is standard. Described in Bulletin PC-1.

Anchoring Jig Bushings

Drill jig bushings can be anchored quickly and accurately by use of MOLDALOY, a new alloy of bismuth, lead, tin, and antimony, developed by *Trethaway Associates*, 37 Wall Street, New York. This alloy has a high melting temperature (430° F.) and is of particular value where speeds and materials tend to generate heat sufficient to soften alloys of lower melting points, thus permitting the bushings to shift.

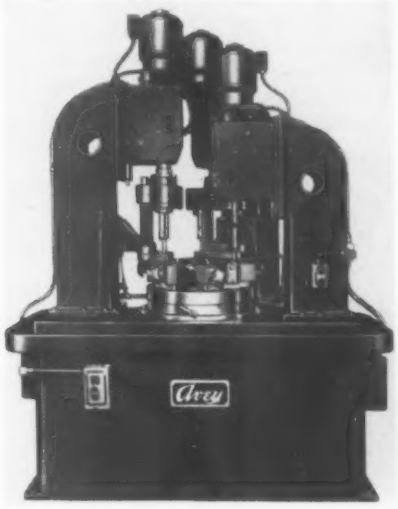


To install a bushing with Moldaloy, the hole in the jig plate is first counterbored to provide at least 3/16" clearance all around the bushing. After bushing and jig plate are preheated to approximately 300° F., the bushing is located and clamped into place. Then, Moldaloy is melted and poured into the recess. Shrinkage after solidifying is only .001" per inch, which leaves the bushings accurately and securely located in place. Other parts as well as bushings can be as successfully located.

T-7-29

Cam Feed Units by Avey

The Avey Drilling Machine Co., Cincinnati, Ohio, offers adaptations of its No. 1 and No. 2 CAM FEED UNITS. Shown is the Avey machine designed particularly for multiple operation on individual holes drilling, counterboring (reaming or re-drilling) and tapping at one clamping of work. This is a self-contained unit with Avey electrical controls for operating and synchronizing multiple unit set-ups.



Because of free loading time and multiple operations of several parts simultaneously in the normal time required for one operation, these Units offer accelerated production and a consequent lower cost per part. Engineering Bulletin No. 645, giving complete information, is available upon request.

T-7-30

New Snyder Special

Designed to perform 22 machining operations on cast iron steering gear housings, a special AUTOMATIC MACHINE designed and built by Snyder Tool & Engineering Company of Detroit, Michigan, drills, bores, chamfers, spotfaces, reams and taps work formerly handled on separate machines. All of these operations are now combined efficiently in a completely automatic cycle machine.

Work-holding fixtures are mounted on an electrically driven, automatic, six-station Geneva index table, and housings are machined by five self-contained Snyder machining units. One housing is completed every fifty seconds. Parts are clamped manually. Both high speed steel tools, cutting at 90 f.p.m., and tungsten carbide tools cutting at 240 f.p.m. are employed. Boring tools are flange-mounted, and drills and reamers are held in adjustable adpators. Base is welded steel, well ribbed and normalized.

T-7-31

North East West South in Industry

W. J. EBERLEIN, who has been elected a Vice-President in Charge of Sales, Greenfield Tap & Die Corp'n, Greenfield, Mass., started with the corporation over 30 years ago as a clerk in the sales department. Mr. Eberlein was successively field eng'r, Detroit dis't sales mg'r, ass't to the sales mg'r at the Greenfield offices, and since '43, sales mg'r.

JULIAN S. NATANSON has joined the staff of **Alden-Langley, Inc.,** Boston, Mass., manufacturers of materials handling, food processing and special equipment. Mr. Natanson, member Boston Chapter ASTE, was formerly with Stevens-Arnold Co., Inc., as project eng'r; and, prior to serving in the armed forces, was tool engineer at Compo Shoe Mach'y Corp'n.

Clark Mfg Company of Cleveland, Ohio, producers of fluid controls for industry, announce that **WILLIAM P. WEBSTER,** former ass't to the sec'y, has been elected to the board of directors.

THE YANKEE PRECISION PRODUCTS CO., 50 Bartholomew Ave., Hartford, designers and builders of electronic and mechanical gages and tools, has consolidated with **Modern Tools,** Berlin, Conn. Offices and manufacturing will be located at the Berlin plant. Modern Tools will continue operation as a division of Yankee Precision Products Co. General Manager is **Edmond Morency** and General Sales Manager, **W. Krause,** both members of Hartford Chapter, ASTE.

J. ROBERT FISGUS, formerly with Cincinnati Planer Co., has joined the sales force of **George Keller Machinery Co.,** Buffalo. An M.E. from University of Cincinnati, he served with the Army Air Corps during the war, flying 37 round trips over the "Hump" in the China-Burma-India theatre.

RUDEL, CAREY & BRIGGS, INC., has been formed by the consolidation of **Rudel-Carey, Inc.,** and **Walter D. Briggs, Inc.,** exclusive manufacturers' representatives and Metropolitan New York distributors of high speed and carbide cutting tools, abrasives and machine tool accessories. Offices and warehouse will be located at former headquarters of Rudel-Carey, Inc., 435 Fourth Ave. (at 30th St.), New York 16.

Shown in photo is the plant of McIntyre Company, manufacturers of pumps and fluid motors, Newton, Mass., which has been recently acquired by Eastern Industries, Inc., and will be known as **McIntyre Div'n, Eastern Industries, Inc.**

Marvin E. Hackstedde has been named Tocco Sales Eng'r with headquarters in Pittsburgh, according to Harry **B. Osborn,** Sales Mg'r, **TOCCO DIV'N** of the Ohio Crankshaft Co., Cleveland. Additionally, Dr. Osborn announced five other Tocco sales eng'r appointments, namely: B. F. **Nemerguth,** with headquarters in Philadelphia; R. W. **Miller,** Cincinnati; **L. R. Farrell,** Buffalo; **L. T. Martensen,** St. Louis; and **George E. Ebbeler** who will work out of the company's Chicago office.

WALTER B. ARCHER has been appointed Detroit Dis't Sales Mg'r for **Hodson Corp'n** of Chicago, to handle that firm's special line of products designed for industrial lubrication.

The **GREATER NEW YORK CHAPTER, ASTE,** recently joined with thirteen other technical societies represented in the New York area to form the **Technical Societies Council of New York, Inc.,** with offices at Engineering Societies Bldg., 29 West 39th St., New York. Representing the ASTE on the Council are **W. C. Rhodes, Jr.** and **J. J. Hogan.** Principal objectives of the Council are the advancement of engineering, scientific, and technical knowledge and the furthering of high professional standards.

ERNEST E. OLDS has been named General Sales Manager for the **Size Control Co.,** div'n of American Gage and Machine Co., Chicago. Previously district sales mg'r, Mr. Olds will now direct all sales of that firm's line of precision gages, as well as single and double roll centerless lapping machines.

Within a few days after fire destroyed the main plant of **ACCURATE SPRING MFG COMPANY** in Chicago, **Frank D. Weber,** President, announced that manufacturing operations had been resumed at 1474 W. Hubbard St., Chicago 22. Contracts have been let for construction of a new fireproof building at the site of the old main plant.

Among the college students enrolling this fall for foundry engineering training at Case Institute of Technology, Cornell Univ., M.I.T., Univ. of Cincinnati and the Univ. of Wisconsin will be 50 students on special scholarships provided by the **FOUNDRY EDUCATIONAL FOUNDATION,** 1010 Public Square Bldg., Cleveland 13, according to announcement by **John M. Price,** President of Ferro Machine & Foundry, Inc., Cleveland, and Chairman of the new foundation. A cooperative venture of the **American Foundrymen's Ass'n, Gray Iron Founders' Society** and **Malleable Founders' Society,** the foundation is expected to make available over a quarter of a million dollars during the next three-year period to carry on such educational work.

ROY V. THOMAS has been named Personnel Mg'r, **Ohio Crankshaft Co.,** Cleveland, according to announcement by W. C. Dunn, company President. Mr. Thomas, a graduate of Baldwin Wallace College in '34, was previously personnel mg'r of the Brewing Corp'n of America, and before that held managerial positions with Telling Belle Vernon Co., and Thompson Products Co.

Further Information on TOOLS OF TODAY Now Available Through Handy Request Form

For your convenience, every item appearing in the popular Tools of Today feature of *The Tool Engineer* is now keyed and further information easily obtained by checking the handy request form below.

Keep abreast of current developments—know what new tools are being marketed to increase production and step up efficiency—turn back now to the start of the Tools of Today feature for this month. Further information on any or all of the items shown can be obtained by circling the corresponding numbers on the form below, and mailing it to *The Tool Engineer*.

Tools of Today Department
THE TOOL ENGINEER
550 West Lafayette Blvd.,
Detroit 26, Michigan

Gentlemen: Please send me further information on the following *Tools of Today* items which I have checked:

T-7-1 T-7-2 T-7-3 T-7-4 T-7-5 T-7-6 T-7-7 T-7-8 T-7-9 T-7-10 T-7-11 T-7-12 T-7-13
T-7-14 T-7-15 T-7-16 T-7-17 T-7-18 T-7-19 T-7-20 T-7-21 T-7-22 T-7-23 T-7-24 T-7-25
T-7-26 T-7-27 T-7-28 T-7-29 T-7-30 T-7-31

New Tools of Today Service

Name.....

Firm.....

Address.....

City.....State.....

Changing Flywheels to Welded Steel

BY L. C. BEATTY, PRES.
BEATTY MACHINE & MANUFACTURING CO., HAMMOND, IND.

In machining flywheel castings for our punches and shears, we occasionally ran into blow holes which necessitated scrapping of the flywheel and resulted in a loss of the machining man-hours. These unfortunate experiences led us to develop a line of welded flywheels built from homogeneous steel plate.

CUTS COST 20%

Not only have we eliminated former scrap losses, but we have cut the cost of our flywheels about 20% with the welded construction.

One of the cast iron flywheels is shown in Fig. 1. A welded flywheel is shown in Fig. 2.

Fig. 1. Flywheel of cast iron construction used formerly.

Fig. 2. A 50" welded steel flywheel after machining.

HOW IT IS BUILT

The 50" flywheel shown in Fig. 2 is built as shown in the sketch of Fig. 3. Interior fillet welds are made with the wheel in the flat position with one pass of ¼" Lincoln "Fleetweld 11" Electrode. The deep-groove welds that join the outer plates to the web are made downhand with the wheel in a motor-driven fixture as shown in Fig. 4. The grooves are filled with ¼" "Fleetweld 11".

We expect soon to install a "Lincolnweld" automatic outfit to make all of these welds. This equipment should reduce the cost of our flywheels even further.

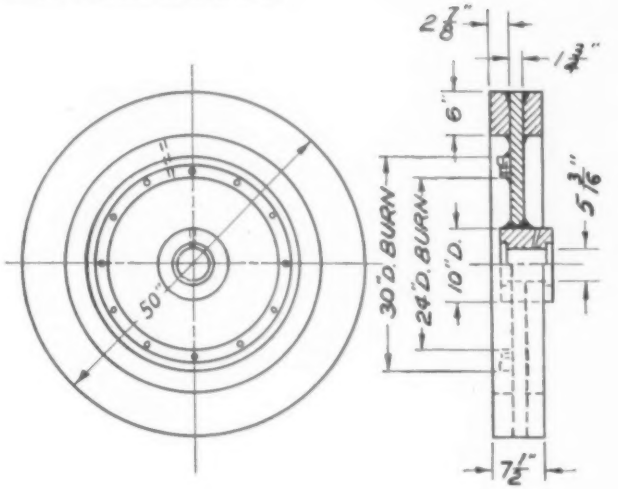


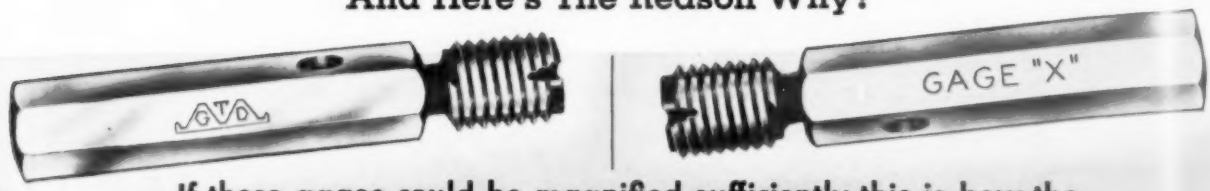
Fig. 3. Construction of welded steel flywheel.

Fig. 4. Welding flywheel in fixture.

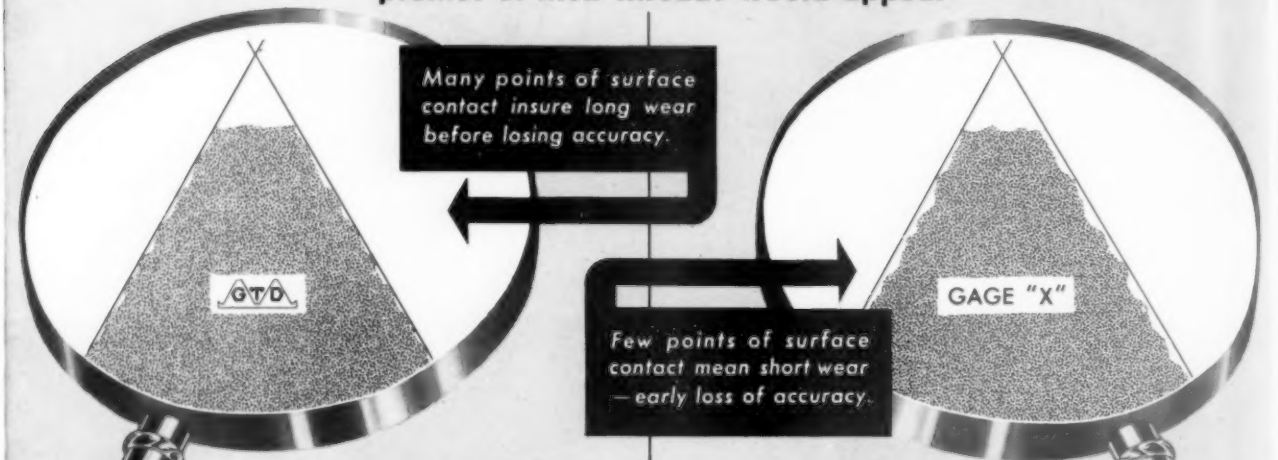
Flywheels comprise just one of many parts for our shears and presses which we have changed over to welded steel design. In this development work we have found it helpful to have the Machine Design Studies published by Lincoln Electric. These may be obtained by writing The Lincoln Electric Company, Dept. 414, Cleveland 1, Ohio.

They Look Just The Same, BUT....

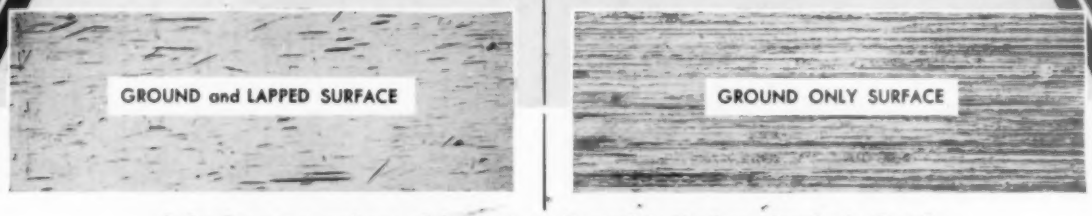
The "Greenfield" Gage Will Outwear Gage "X" Many Times. And Here's The Reason Why!



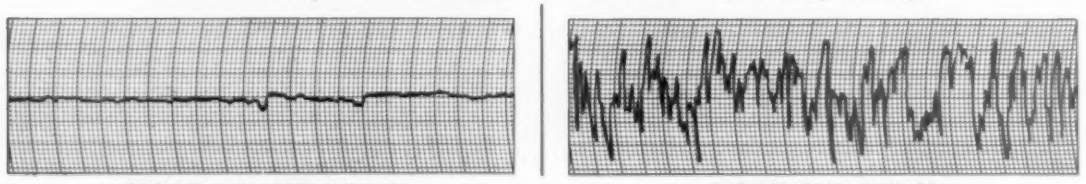
If these gages could be magnified sufficiently this is how the profiles of their threads would appear



A comparison of ground and lapped, and ground only surfaces is indicated in the following Microphotographs.



A further comparison of finish is indicated in Surface Analysis Graph.



GROUND and LAPPED SURFACE — GROUND ONLY SURFACE

Both gages will pass all measurement requirements. But the "Greenfield" Gage, because of its finely lapped surface, will outwear the other many times. *All* "Greenfield" Gages are lapped to an extremely high degree of finish. This "inbuilt" extra wear which gives long and accurate service and better value to users, is one reason for "Greenfield's" reputation in the gage field. *For better gaging, "GO" Greenfield.*

GTD Greenfield 75th YEAR

GREENFIELD TAP and DIE CORPORATION · Greenfield · Massachusetts
and its New Haven Division The GEOMETRIC TOOL COMPANY

NICKEL CAST IRON...

...for IMPROVED HEAVY PLANERS

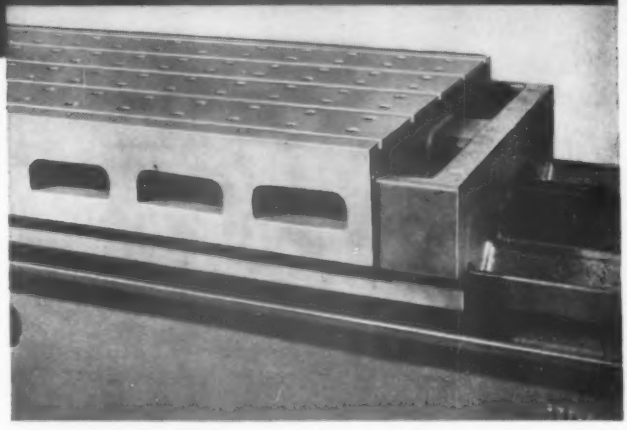
This Rockford planer incorporates a basic improvement: *the application of hydraulic pressure to a straight line table drive.*

Developed by the Rockford Machine Tool Company, this advanced design not only reduces the number of moving parts, but completely eliminates rack and gearing, with their high inertia forces . . . thus making possible greater convenience and speed of operation with high accuracy.

Heavy feeds and speeds of the planer, naturally, call for good wear-resistance on working surfaces. Moreover, the hydraulic controls require sound, pressure-tight, readily machinable castings. Accordingly, Rockford engineers specify a Nickel-chromium iron for tables, feed cylinders, saddles, tool slides, valve bodies and other parts of the hydraulic system.

"This Nickel alloy iron," states Rockford, "has proved its value in the production of long-lasting cast parts, free from scoring on the ways of sliding members, and from leaks or pressure losses where hydraulic stresses are high."

When you need parts for tough jobs . . . think of Nickel alloys.



IN PARTS LIKE THESE . . . *Rockford minimizes scoring of surfaces, by use of Nickel alloyed iron that provides strong, dense grained castings.*

EMBLEM OF INCO SERVICE

TRADE MARK

Over the years, International Nickel has accumulated a fund of useful information on the selection, fabrication, treatment and performance of engineering alloy steels, stainless steels, cast irons, brasses, bronzes and other alloys containing Nickel. This information and data are yours for the asking. Write for "List A" of available publications.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N.Y.

RACINE HYDRAULICS

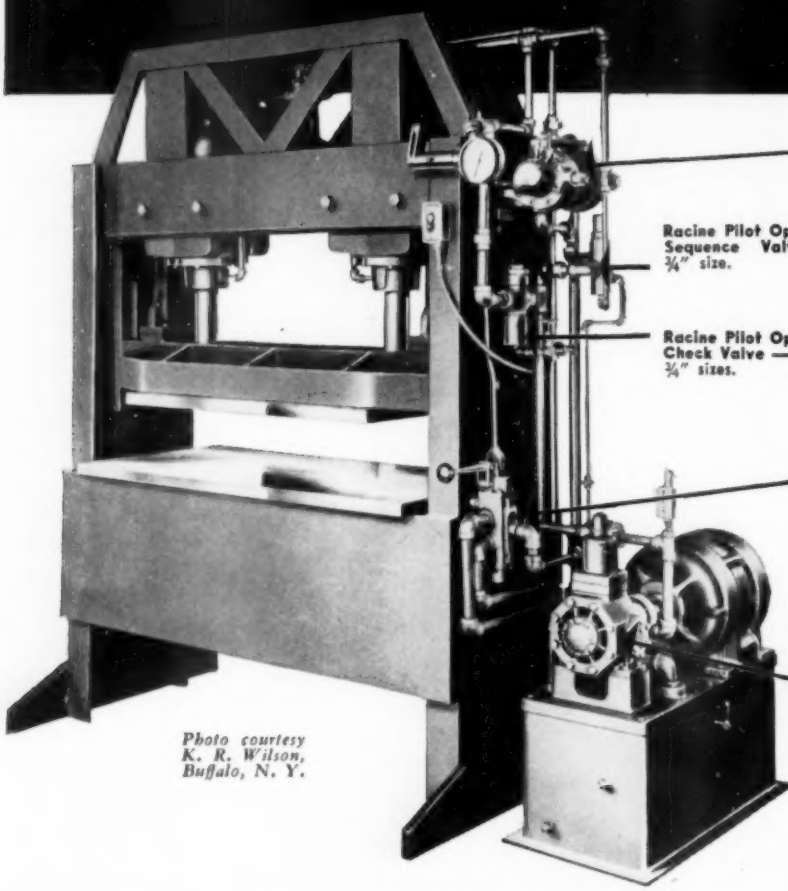
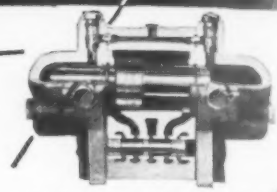


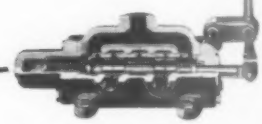
Photo courtesy K. R. Wilson, Buffalo, N. Y.

Racine Pilot Operated Sequence Valve — ¾" size.

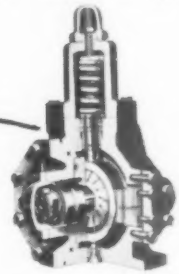
Racine Pilot Operated Check Valve — ⅜" to ¾" sizes.



Racine Hydraulic Pressure Booster — Converts low pressures into high pressures in ratios ranging from 3:1 to 7:1.



Racine Four-Way Hydraulic Valve — Balanced Piston — Sleeve Type construction. Manual, Mechanical and Electrical control. Sizes ⅜" to 1½".



Racine Variable Volume Oil Hydraulic Pump — 12 to 30 G.P.M. Pressure 50 to 1000 lbs. p.s.i.

INTEGRATED TO YOUR DESIGN . . . CENTRALIZED OR REMOTE CONTROL

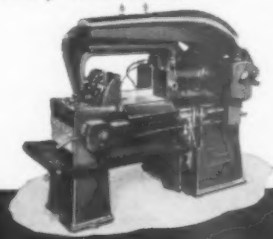
Like this press manufacturer, you can readily give your products the advantage of a RACINE "Variable Volume", hydraulic circuit. This feature saves horsepower and reduces heat by simplifying the installation and eliminating unnecessary relief and bypass valves. Important savings in first cost also result.

RACINE Hydraulic Engineers have developed hydraulic operation and control for hundreds of machines and tools. Their experience can be helpful in applying "RACINE Hydraulics" to your present product and on new designs now in the development stage. They will cheerfully review your problems in power movement, without cost or obligation.

Let us submit detailed recommendations and circuits employing pressures as high as 3000 lbs. p.s.i. Utilize the Variable Volume feature of RACINE Pumps and easy operating, long-lived RACINE sleeve-type valves. Ask for RACINE catalog P-10-C today. RACINE TOOL AND MACHINE COMPANY, 1774 State St., Racine, Wisconsin.

RACINE *Hydraulic* METAL CUTTING MACHINES

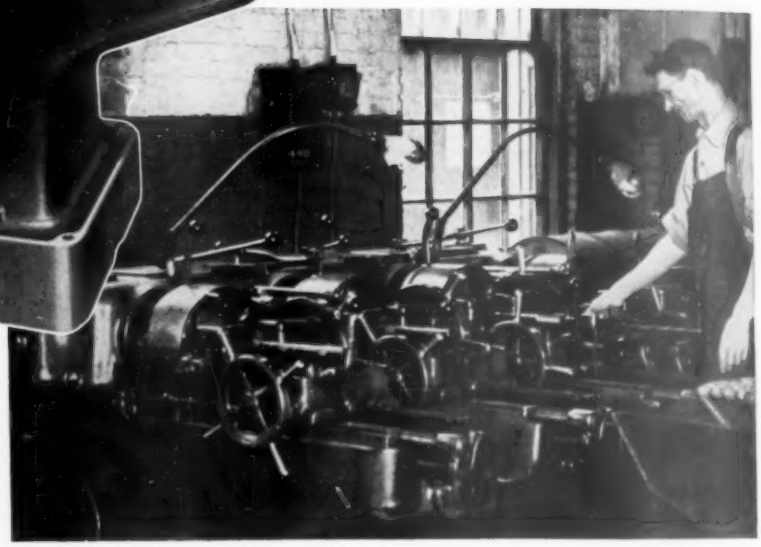
A complete line in capacities 6" x 6" to 20" x 20". Models in all price ranges — featuring simple one lever control — open front design — progressive feed for cutting any metal from light tubings to structural shapes and billets of tough tool steels. Write for complete catalog No. 12.



RACINE — STANDARD FOR QUALITY AND PRECISION

Cost Still Counts

THE LANDMACO THREADING MACHINE ASSURES MINIMUM OPERATING COSTS



The facts below have been proven in hundreds of installations. May we show you why the Landmaco Threading Machine can be profitably employed on your threading operations.

Write for Bulletin No. H-75

The Landmaco Threading Machine is the preference in most railroad shops for threading staybolts, taper head crown bolts, header bolts, etc. First, because the machine is easily set up—efficient for short run jobs. Second, it is geared for high threading speeds assuring maximum production. Third, the Landmaco employs the Landis long life Tangential Chaser which reduces tool cost to a minimum by producing more threads per grind and innumerably more threads per set of chasers.

1947 Machine Tool Show

LANDIS MACHINE COMPANY, WAYNESBORO, PENNA, U.S.A.

Choice

High carbon—chromium, excellent wear resistance. Specially adapted for compressive forming.

Marvel

Low carbon—high tungsten, for top service at dull red heat. Maintains hardness, resists heat cracks. High toughness—high wear resistance—high heat resistance.

Hotpress

Low carbon—low chromium—high tungsten. For rod and tube extrusion, general hot pressing. High toughness—high heat resistance—stands water cooling.

Die steels for hot work

Hotform

The original 5% chromium hot work die steel. Exceptional strength at elevated temperatures. Most widely-used steel for light-metal casting dies.

Forge-Die

13.50—14.50% tungsten. Delivers exceptional service on upsetter headers and dies, piercing punches, etc., resisting heat checking and scoring. High strength—high heat resistance.

Red Cut Superior—J Temper

.50% carbon—18.00% tungsten hot work die steel, for highest heat and wear resistance.

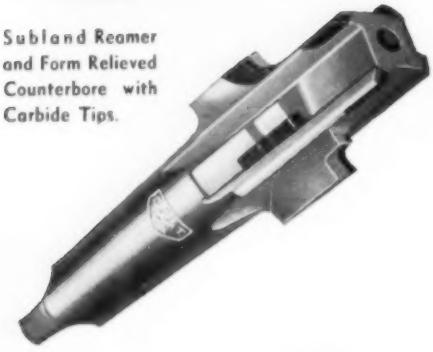
First Quality Tool Steels, furnished in billets, bars, cold drawn shapes, solid forgings, ring forgings, sheet, plate, circles and drill rod.

Vanadium-Alloys
STEEL COMPANY
LATROBE, PENNA.

COLONIAL STEEL DIVISION

ANCHOR DRAWN STEEL CO.

CARBIDE-TIPPED TOOLS *with* HIGH-SPEED STEEL BODIES REDUCE PRODUCTION *Costs!*



Subland Reamer and Form Relieved Counterbore with Carbide Tips.

Taper Shank Chamfering Cutter with Carbide Tips.

Step Reamer with Carbide Tips.

Users of Carbide-Tipped Tools, brazed on hardened High-Speed Steel Bodies, have proven to their own satisfaction that, because of their higher cutting efficiency, they materially reduce production costs.

The high-speed steel body naturally provides a much harder base for the carbide tips, thereby reducing "spring-back" under heavy cuts.

Then too, the flutes and pilots, because they Rockwell C-62-63 throughout their entire length, do not score or pick-up, the pilot giving much longer wear.

The result is that Carbide-Tipped Cutting Tools with HIGH-SPEED STEEL BODIES give you smoother operation, longer tool life and reduced production costs. You get not only top-quality tools but also top-quality work.

Our engineers will be glad to work with you on your problems.

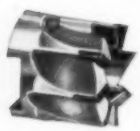
• **MADE TO YOUR SPECIFICATIONS** •

DETROIT REAMER & TOOL CO.

2830 E. Seven Mile Road **Detroit 12, Michigan**

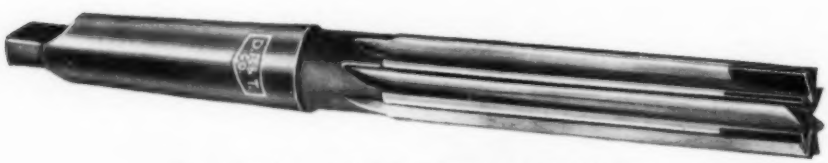
Manufacturers of Oil-Hole Drills, Subland Drills, Special Reamers, Circularity Relieved Reamers, End Mills and Special Tools

Spiral Shell End Mill with Carbide Tips.



Straight Flute Shell End Mill with Carbide Tips.

Taper Shank Core Drill with Carbide Tips.



Taper Shank Straight Flute Reamer with Carbide Tips.

Write for QUOTATION

SUBLAND REAMERS
LINE REAMERS
CENTER DRILLS
COUNTERBORES
CORE DRILLS
END MILLS

Special Tools To Your Specifications

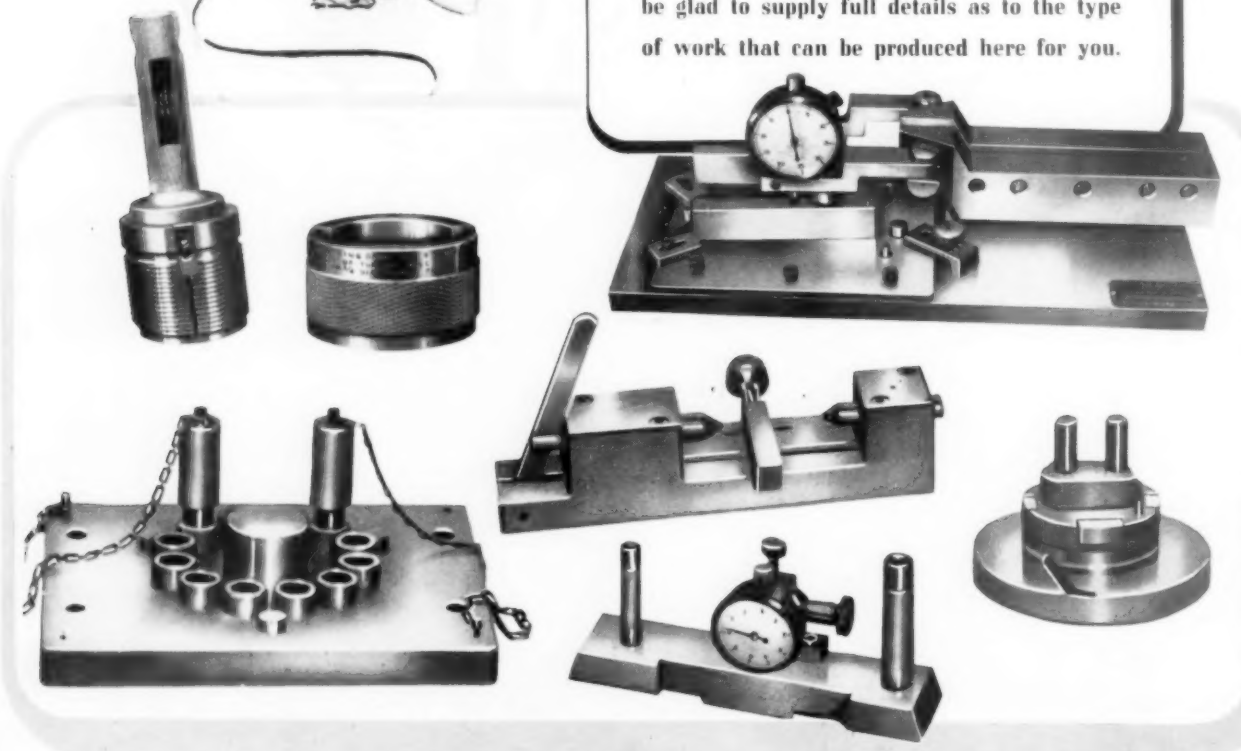
A COMPLETE LINE
of fine Machinists' Tools

...We urge buying through the Distributor

BROWN & SHARPE TOOLS

looking for ?

. . . *SPECIAL GAGES* or tools, fixtures and parts built to closest precision limits? Lincoln Park has a department devoted exclusively to special work. Here are combined the experience of skilled gage makers and the facilities of one of the country's finest gage plants. We'll be glad to supply full details as to the type of work that can be produced here for you.



Lincoln Park INDUSTRIES, INC.

1729 FERRIS AVENUE • DETROIT 25, MICHIGAN

IT takes years for a company to build a reputation for fine engineering, for painstaking workmanship, reliable service and far-sighted vision. • We have adopted this new trade-mark to become a symbol of the reputation which we enjoy today throughout industry.

• We regard this trade-mark as a challenge--to continue improving on our past achievements, so that we may be of even greater service to our customers in the years ahead.

THE HEALD MACHINE COMPANY

Worcester 6, Mass.

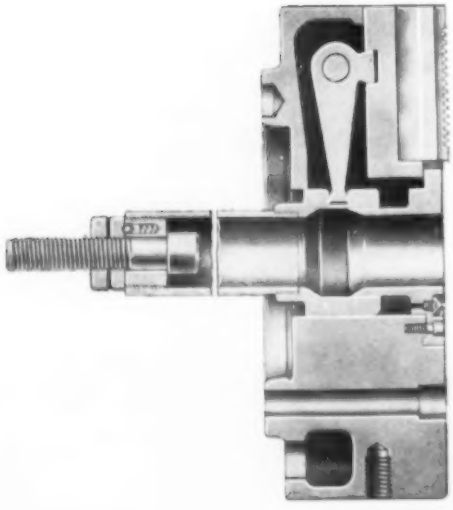
Branch Offices in Chicago • Cleveland • Dayton • Detroit
Indianapolis • Lansing • New York

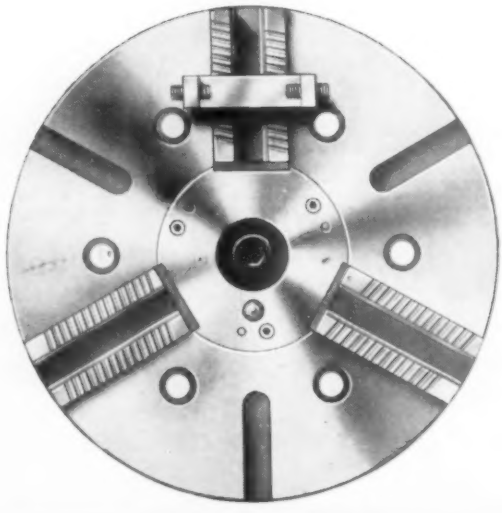
INTERNAL AND SURFACE GRINDING MACHINES BORE-MATIC PRECISION FINISHING MACHINES

CUSHMAN *Announces*

A COMPLETE NEW SERIES OF AIR POWER OPERATED CHUCKS *and* DEVICES

...developed to aid the Metal Working industries in increasing production and reducing Production Costs





1947 MACHINE TOOL SHOW
CHICAGO SEPT 17-26
BOOTH 271

CUSHMAN
AIR POWER OPERATED CHUCKS

WITH THESE TIMELY FEATURES

● **New "Accralock" precision jaw adjustment feature** on adjustable serrated jaw chucks provides most precise and positive method yet devised for this important adjustment.

● **New one-piece, light weight steel chuck bodies,** with weight correctly distributed to assure rigidity and maintained accuracy while reducing flywheel effect in high speed operation.

● **New simplicity in design,** with all working parts enclosed and effectively sealed against entry of dirt or chips.

● **New PRECISION in construction** and close tolerance fit of all parts. Chuck bodies accurately balanced.

● **New more rugged operating mechanisms** with wearing parts of correctly selected and hardened alloy steels.

A comprehensive series of chucks in adjustable serrated jaw . . . manufacturing . . . screw adjustable . . . and compensating jaw styles. Also 2-jaw round body and gib type chucks and collet chucks.

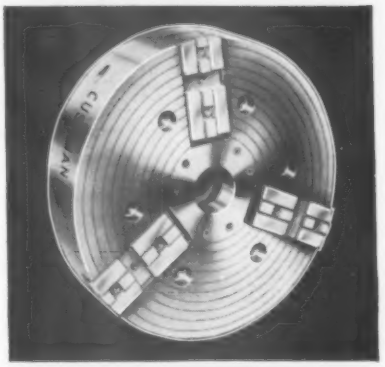
Furnished with both straight recess and American Standard tapered recess mountings. American Standard jaws and top jaws.

Newly designed rotating air cylinders and air control equipment developed to assure a "balanced" power system. Easily installed, compact and efficient, greatly reduced maintenance.

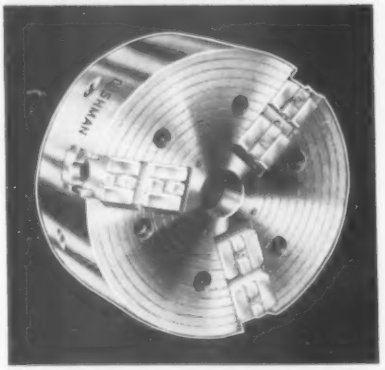
A comprehensive series of stationary air cylinders widely adaptable to shop and machine tool applications calling for powerful, dependable units with precision control.

THE CUSHMAN CHUCK COMPANY
Hartford 2, Conn.

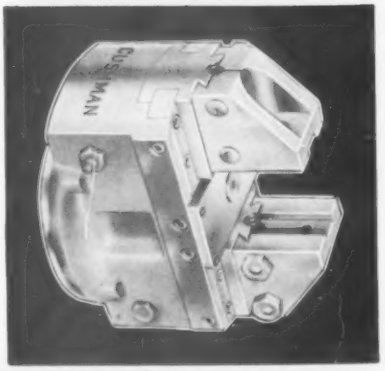
Series 5238A-1 "Accralock" Chuck



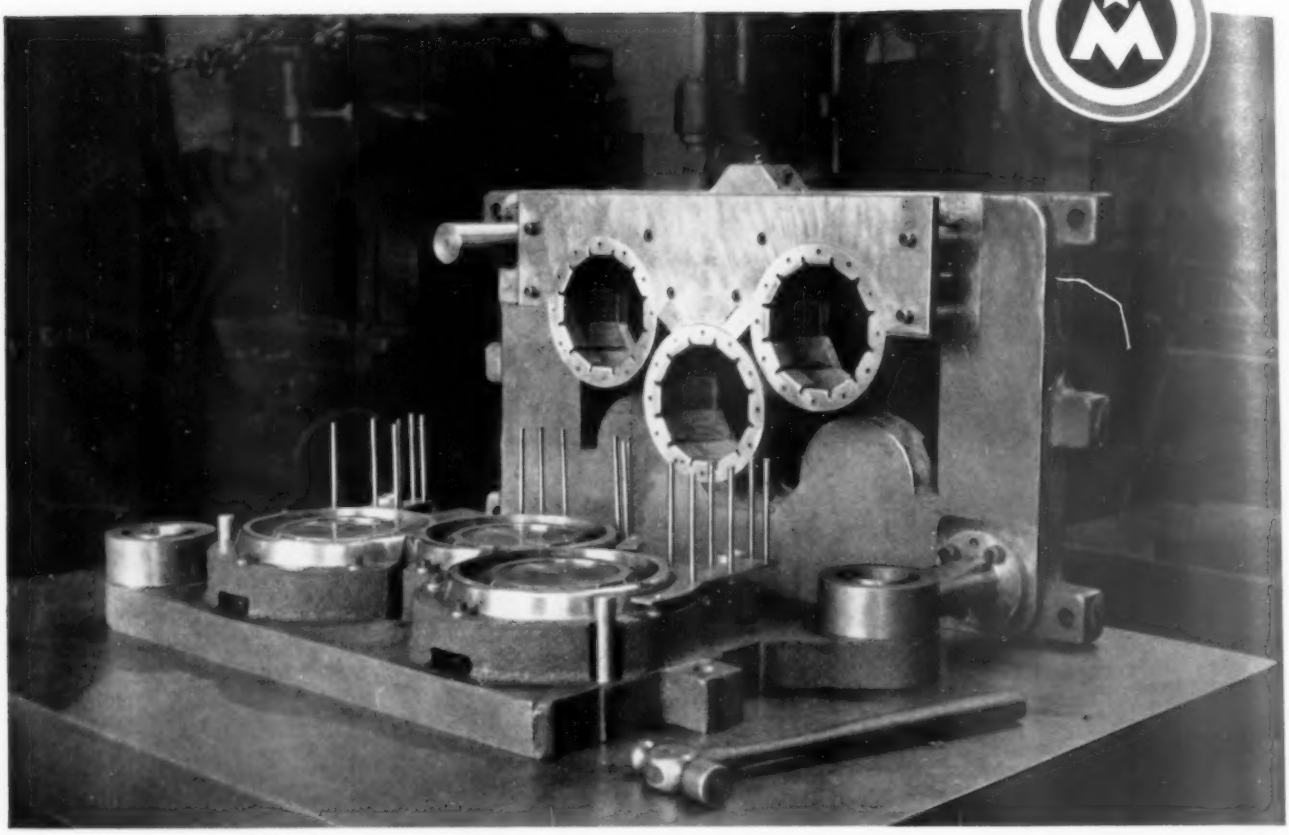
Series 5236A-1 Manufacturing Chuck



Series 8236A-1 Screw Adjustable Chuck



Series 4026 2-Jaw Gib Type Chuck



MIDVALE ALLOY DIE STEELS

Midvale Alloy Die Steels are the product of constant research and development directed toward producing materials best adapted to your particular requirement. They include steels for lamination dies, forming dies, gauges, jigs, blanking dies, broaches, thread rolling dies, etc. Grades regularly produced and carried in stock are Midvale Diamond Brand (high carbon-high chrome), Midvale Diamond A (high carbon-high chrome), Midvale Constant, Midvale ND and Midvale #77.

Specific information concerning these materials is available upon request in the form of printed matter. Our metallurgical staff will be glad to make suggestions based upon your special needs.

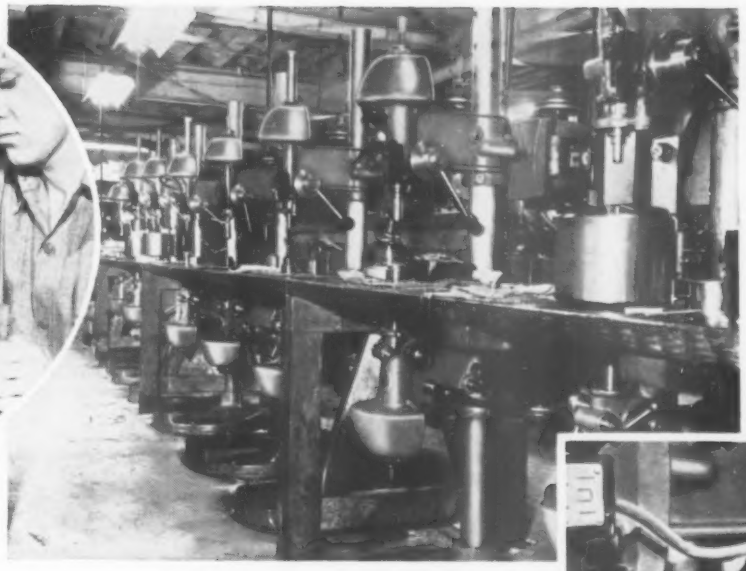
THE MIDVALE COMPANY • NICETOWN • PHILADELPHIA

OFFICES: NEW YORK • CHICAGO • PITTSBURGH
WASHINGTON • CLEVELAND • SAN FRANCISCO

MIDVALE
Custom Steel Makers to Industry

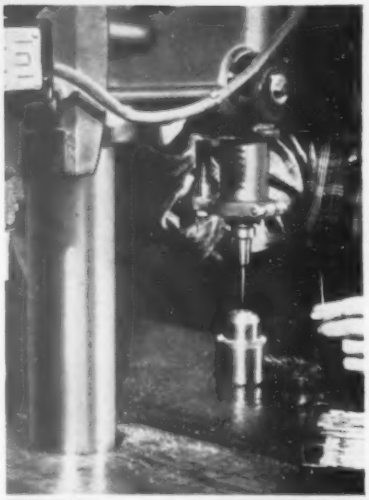
STAINLESS AND TOOL STEEL BARS
•
CORROSION AND HEAT RESISTING CASTINGS
•
FORGINGS AND RINGS

Turning with 15" Walker-Turner Drill Press.



A battery of twelve threading machines made up with two Walker-Turner drill heads on each column. Produce class #3 threads at very fast production.

Tapping with 15" Walker-Turner Drill Press.



Threading with Walker-Turner Drill Press

"We Make Screw Machine Parts . . . . . with 30% Production Increase"

CHARLES MARTI

Charles Marti, manufacturer of precision screw machine products, has combined screw machine techniques with Walker-Turner 15" Drill Presses with remarkable results.

"We have 58 Walker-Turner Drill Presses in our plant, all used in the manufacture of small screw machine parts ordinarily made on Swiss Automatics. These parts range in size from 1/32" to 3/8" in diameter, 3/4" to 5" long and are held within .002 limits.

"Each machine performs a single operation. All machines are equipped with special turning fixtures which are adjustable to any size; twelve installations have two heads mounted on each column and do the work of threading machines. All tools and bushings are submerged in oil.

"With this method, we showed a 30% increase in production in the manufacture of needles for lettering pens as compared with the former screw machine method. All work is done by unskilled operators.

"We intend to continue using this method because it assures flexibility of operation, and is particularly economical in making short runs. New jobs do not require sets of cams, only resetting of tools."

CHARLES MARTI, *President*
Charles Marti Precision Screw Machine Products
Newark, N. J.

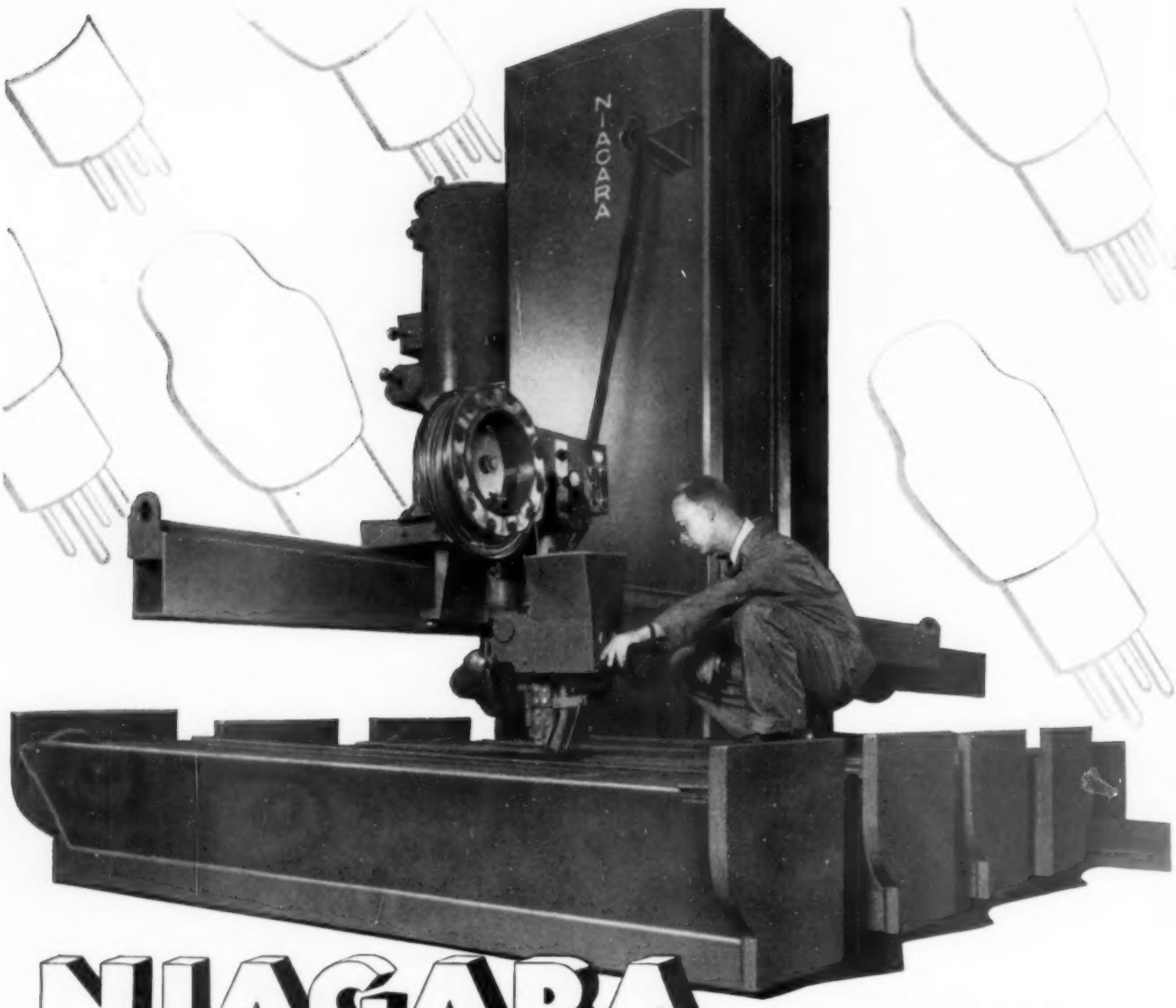
TWENTY-FIFTH YEAR
1922 1947

SOLD ONLY BY AUTHORIZED INDUSTRIAL MACHINERY DISTRIBUTORS 161

walker-Turner
COMPANY, Inc.
PLAINFIELD, N.J.
U.S.A.

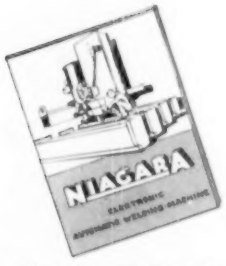
MACHINE TOOLS

DRILL PRESSES—HAND AND POWER FEED • RADIAL DRILLS • RADIAL SAWS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS



NIAGARA *announces*

a new ELECTRONIC AUTOMATIC WELDING *machine*



The advantages of mechanized Automatic Welding are illustrated in Bulletin 83. Write for your copy.

• One man operation, faster welding, less passes per seam, stronger and better quality welds at lower labor costs are made possible by this new Niagara Electronic Automatic Welding Machine.

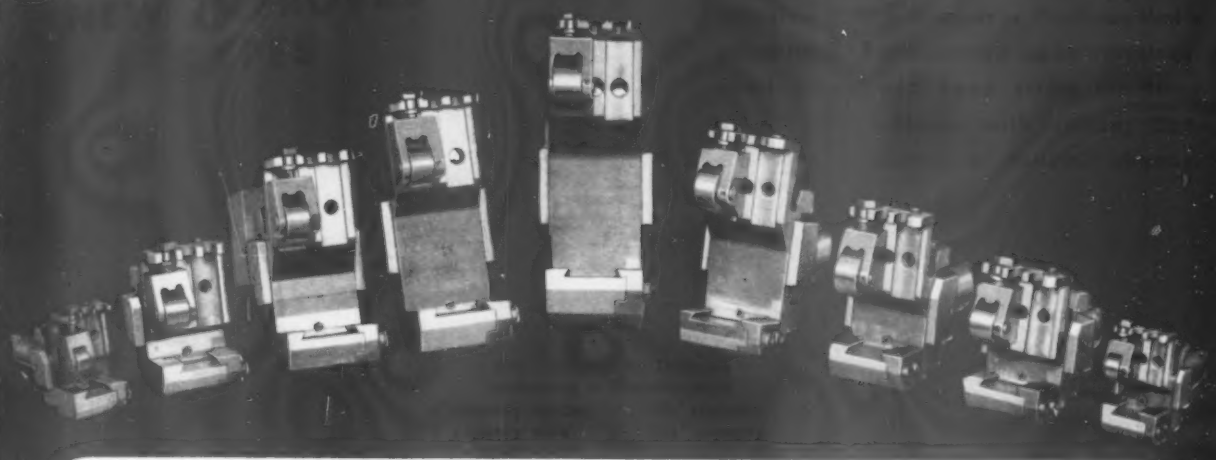
Electronic control provides variable speed of the machine along a track so that the length of welding is governed only by the track length. Welds perpendicular to the track are accomplished by traveling the welding head at a variable speed along the cantilever beam. Centralized fingertip, push button control quickly brings the power elevated beam to any height position thereby providing maximum speed in changing from one setup to the next whether the job be a long slender member or a massive frame.

NIAGARA MACHINE AND TOOL WORKS

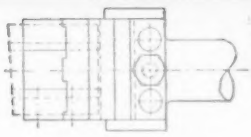
District Offices: CLEVELAND • NEW YORK • DETROIT

637-697 NORTHLAND AVE., BUFFALO 11, N. Y.

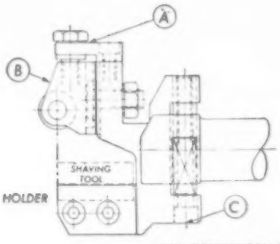
Slitters



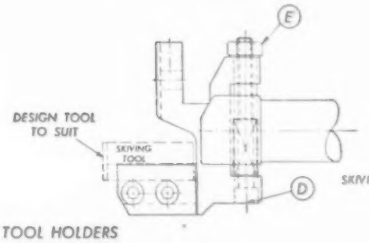
NOTE:
TO CONVERT SHAVING TOOL HOLDERS TO SKIVING TOOL HOLDERS FOLLOW THESE FIVE EASY STEPS.
1—REMOVE PRESSURE PLATE "A"
2—REMOVE ROLL HOLDER "B"
3—REMOVE SOC. H'D. SCREW "C"
4—REPLACE "C" WITH LONGER SCREW "D"
5—ADD LOCK NUT "E"



INSTRUCTIONS:
ADJUST SCREW "D" TO POSITION TOOL TO SKIVE DESIRED DIA. OF WORK. AFTER ADJUSTMENT IS MADE LOCK IN PLACE WITH NUT "E."



STANDARD SHAVE TOOL HOLDER
PATENT No. 2-364-320



SKIVING TOOL HOLDER

ST'D. "SLITTERS" SHAVING TOOL HOLDERS
CONVERTED TO SKIVING TOOL HOLDERS

FOR RESTRICTED CENTER DISTANCES

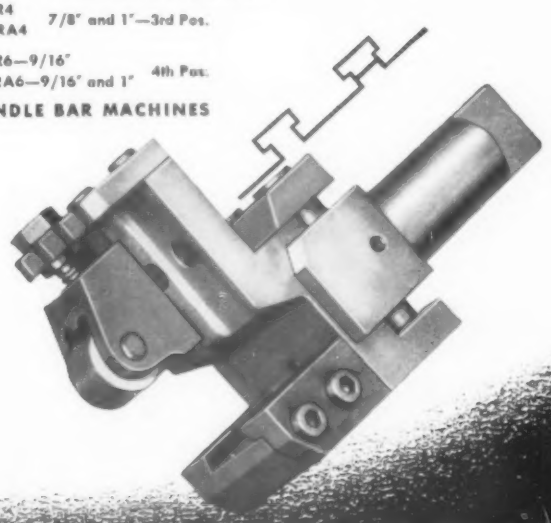
R4
RA4 7/8" and 1"—2nd Pos.

R4
RA4 7/8" and 1"—3rd Pos.

R6—9/16"
RA6—9/16" and 1" 3rd Pos.

R6—9/16"
RA6—9/16" and 1" 4th Pos.

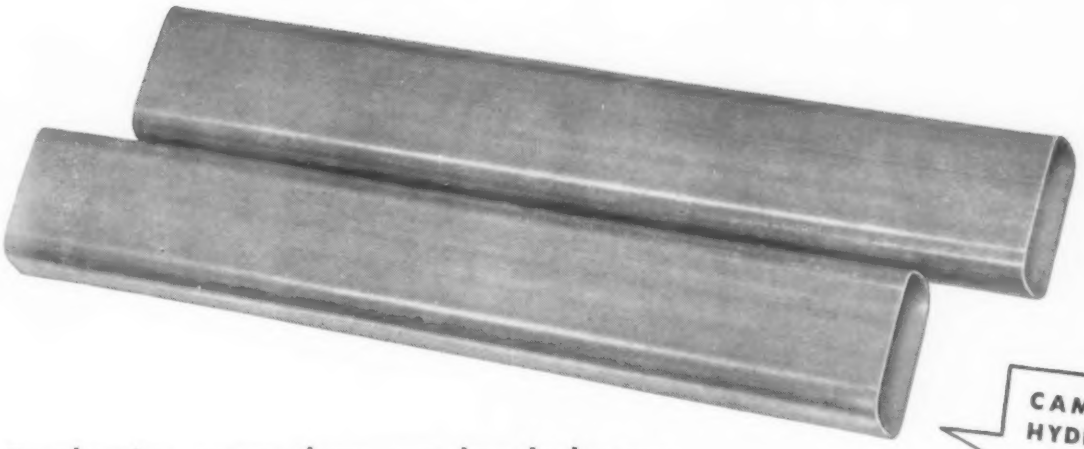
ACME-GRIDLEY MULTIPLE SPINDLE BAR MACHINES



SCREW MACHINE TOOL COMPANY

MANUFACTURERS OF ACCESSORY TOOLS FOR ALL TYPES OF AUTOMATIC SCREW MACHINES

CUTS IRREGULAR SHAPED TUBING ABRASIVELY—4 TIMES FASTER!

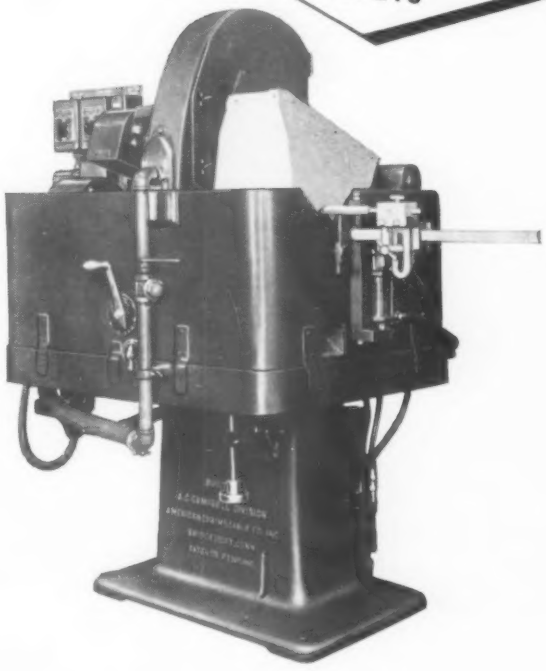


Production more than quadrupled over other methods by putting this operation on Campbell 213 Wet Abrasive Cutting Machine.

BRIDGEPORT, CONN.—The tubing illustrated is 1¼" x 2¼" with 1/32" wall. Because of its shape it presented a problem when cut by ordinary methods. By putting it on the Campbell 213, actual cutting time was reduced from more than half a minute to only 2 seconds per cut. Result—faster cuts to close tolerances, no distortion, minimum burr.

Campbell offers a complete range of abrasive cutting machines, including wet and dry, hand-operated, semi-automatic and full automatic. They are more than just cut-off machines. In many cases, we have designed fixtures which adapt abrasive cutting to operations such as this tube-cutting job formerly done by other types of machines. And the result has been greatly reduced production costs.

CAMPBELL HYDRAULIC NO. 213



***Perhaps you have operations** which could be profitably done by abrasive cutting. Our engineers will be glad to work with yours.*

ACCO

TRADE MARK

ALSO MAKERS OF A COMPLETE LINE OF NIBBLING MACHINES

ANDREW C. CAMPBELL DIVISION
AMERICAN CHAIN & CABLE • BRIDGEPORT, CONN.

Simplify and Sav

on Hydraulic Systems

with VICKERS

POWER UNITS

The "hydraulics" on this Ingersoll 24-Station Process Machine transfers the transmission castings from station to station and provides power for clamping, locating and chip disposal. The hydraulic system design was simplified and cost reduced by using the twelve standard Vickers Self-Contained Hydraulic Power Units shown.

These units provide a compact hydraulic power package which can be applied to almost any system. They are available with various pump combinations to meet a wide range of requirements up to pressure demands of 2,000 psi. There are 92 standard sizes and types of single stage, two stage and dual pressure pumps equipped with motors from ¾ to 20 hp.

The oil reservoir serves as a base to save floor space. On it is mounted a standard Vickers Motorpump or a Vickers pump with separate motor drive. A Vickers "balanced piston type" pressure relief valve provides accurate control of hydraulic pressure. A simple wrench adjustment sets maximum operating pressure at any desired figure within recommended pressure range. Filters and reservoir are readily accessible for cleaning. See Bulletin 46-43 for the many other features.

Vickers Hydraulic Power Units are frequently the most desirable source of hydraulic power. Vickers application engineers will be glad to discuss your hydraulic power and control problems.

3158

Birdseye view of Ingersoll 24-Station Process Machine (130 feet long) that performs 170 different drilling, tapping and milling operations, producing automobile transmission housings at the rate of 100 per hour.

Write for new Bulletin 46-43 describing Vickers Hydraulic Power Units

VICKERS Incorporated

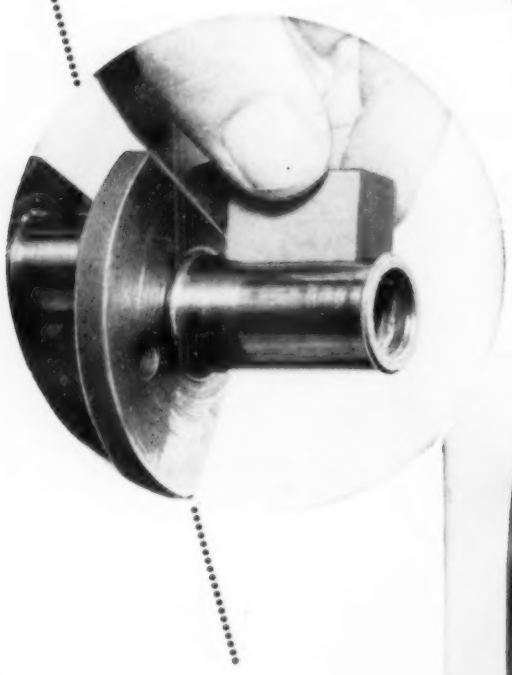
DIVISION OF THE SPERRY CORPORATION

1416 OAKMAN BLVD. • DETROIT 32, MICHIGAN

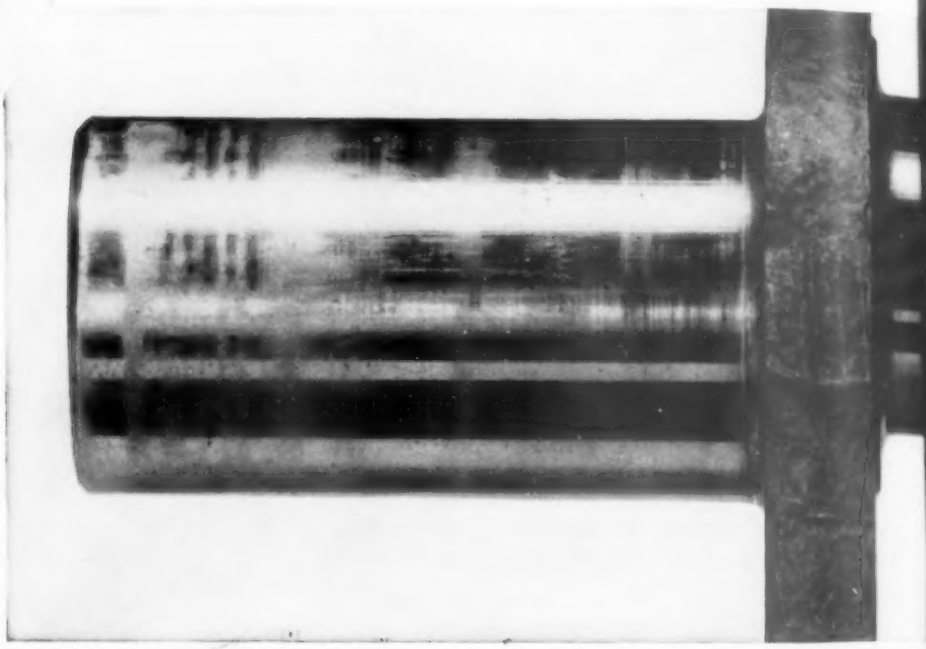
Vickers Engineering Offices: ATLANTA • CHICAGO • CINCINNATI • CLEVELAND
DETROIT • LOS ANGELES • NEWARK • PHILADELPHIA • ROCKFORD
ROCHESTER • SEATTLE • ST. LOUIS • TULSA • WASHINGTON • WORCESTER

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

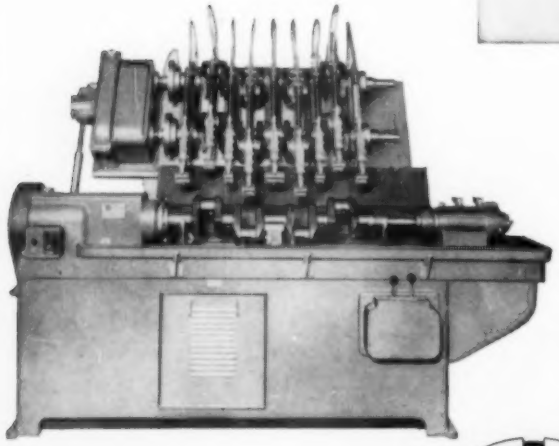
how SUPERFINISH proves a point



In a few seconds you can demonstrate the difference between a sanded and a Superfinished surface. Here, on a small crankshaft for an outboard motor, a Superfinishing stone curved to the exact radius of the part is held by hand and oscillated as the shaft is rotated. In a matter of seconds, as shown below, enough "smear metal" (softened by grinding heat) is removed to reveal the grinder ridges and flats, feed spirals, chatter marks and other defects injurious to bearings. Because the Superfinishing stone is rigid, it corrects *geometrical shape,* whereas emery cloth, being pliable, merely polishes the surface.



GISHOLT CRANKSHAFT SUPERFINISHER. All bearing surfaces on 6 or 8 cylinder crankshafts are superfinished simultaneously.



In a minute or less—on a Gisholt Superfinishing Machine—these surface defects will disappear, and a truly hard surface will be exposed. And the result is not only greater surface smoothness but a nearly perfect geometrical form.

Superfinishing actually increases load carrying capacity by *decreasing* the depth of the oil film. Less heat is generated, the bearing is more efficient, longer lived.

A very quick and inexpensive process, Superfinishing pays for itself many times over in better service and the elimination of bearing failures. A variety of Gisholt Superfinishing Machines is available for different types of work. Ask Gisholt engineers for complete information about them.

1947 MACHINE TOOL SHOW CHICAGO

See Gisholt Superfinishers at work at the Machine Tool Show.

GISHOLT

GISHOLT MACHINE COMPANY

1245 East Washington Avenue • Madison 3, Wis.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Here They Are In One Handy Box...

The 16 Most Popular Shapes and Sizes of Norton Mounted Points

HANDY to buy, handy to use, handy to keep — that's the Norton No. 16 Mounted Point Assortment. It's made up of one each of the sixteen sizes and shapes which Norton sales records show are most in demand. They're packaged in an ingenious box which brings them to you safely, serves as a handy holder while they are in use and a sturdy container when they are not.

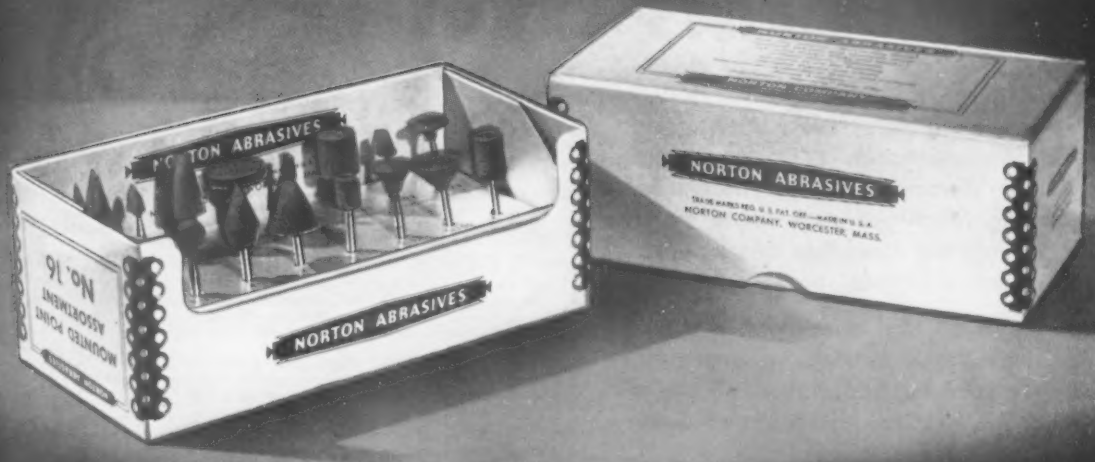
The points are the same Norton product that's been so popular with tool makers for years. They are made of fast, cool cutting 38 ALUNDUM abrasive, vitrified bonded and strongly cemented on steel spindles.

Order one or more No. 16 Mounted Point Assortments from your Norton distributor.

NORTON COMPANY, WORCESTER 6, MASS.

Distributors in All Principal Cities

W-1089

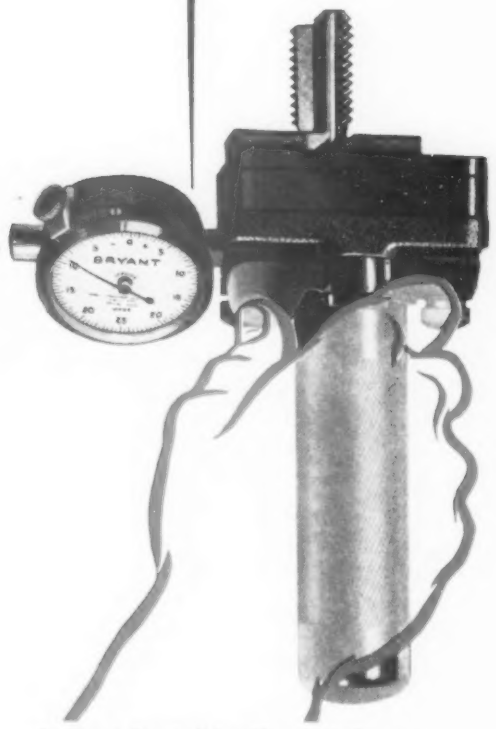


NORTON ABRASIVES

Another BRYANT Postwar Development

The new Bryant Portable Thread Gage offers a faster, more accurate inspection method for checking internal threads in large castings or parts still chucked in the machine. *It is the only gage which quickly and visually indicates internal thread size with master gage precision.* A glance at the large dial indicator immediately shows accumulated inaccuracies of pitch, lead, thread form and diameter or presence of burrs. The new portable — constructed on the same principle as the proven Bench model — is faster, simpler, and constantly accurate. There's no tedious threading, no feeling for fit, and none of the rapid taper wear that is encountered with conventional gages.

The new Bryant Portable Thread Gage brings to every corner of your plant a modern, foolproof, time-saving method for internal thread gaging. It will cut your inspection costs to a new low while adding speed to your production line. Write today for new bulletin giving complete details.



Bryant Portable Thread Gage

Also Universal Diameter Gage, Squareness of Face Units, Adjustable Thread Gage

BRYANT

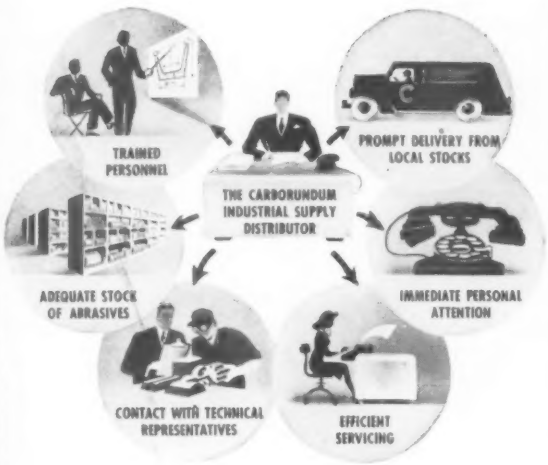
BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

A BUYING GUIDE FOR ABRASIVES

POINT No. 6

LOCAL DISTRIBUTOR SERVICE



With progressive purchasing methods dictating improved efficiency of supply, the services of your CARBORUNDUM distributor assume increased importance. Prompt delivery of standard wheels, coated abrasives, sticks and stones, and grains by CARBORUNDUM is assured from large and varied stocks conveniently located nearby. Factory inventories of these items can be safely and economically reduced. More efficient use of abrasives is promoted through a local staff, trained by CARBORUNDUM, and familiar with varied applications. They are informed on latest developments and have access to CARBORUNDUM representatives when the problem is too difficult or unusual. Intelligent handling and efficient office routine is also pointed to by some customers who prefer the personal consideration and attention rendered by these modern distribution units. These services account in part for the increasing preference for products by CARBORUNDUM. The Carborundum Company, Niagara Falls, New York.

A Good Rule for Good Grinding: ...CALL IN

CARBORUNDUM

TRADE MARK

BONDED ABRASIVES
COATED ABRASIVES
ABRASIVE GRAINS AND FINISHING COMPOUNDS

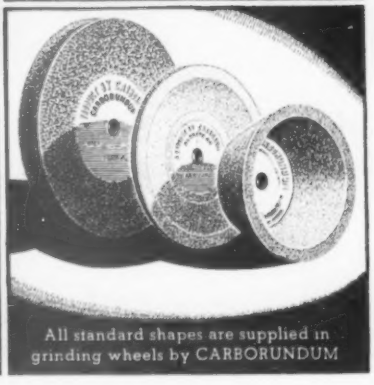
Tool Room sticks and stones that cut fast... last long... and hold their form

Mounted wheels, in all standard grits and grades, for portable grinding equipment

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company

Cutting-Off Wheels ... the modern tool for faster, less costly, more finished cuts

A Coated Abrasive for every sanding and finishing condition



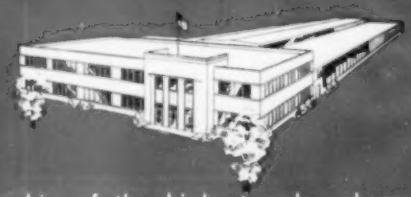
All standard shapes are supplied in grinding wheels by CARBORUNDUM

WHATEVER YOU DO . . .

WINTER ENGINEERS Can Help Solve Your TAPPING PROBLEMS

The services of WINTER Engineers are easily available to you for the solution of your tapping problems. Whatever type of work you do, wherever you may be, if you have a tough threading job, a call to your local WINTER distributor will quickly bring the assistance of all WINTER engineering facilities. These include carefully collected and classified case histories on almost every possible type of threaded work.

Leadership **BUILDS ON** *Craftsmanship*



Craftsmanship of the highest order always has been employed in the manufacture of WINTER Taps.

YOUR LOCAL DISTRIBUTOR carries a complete stock of WINTER Taps on his shelves —as close to your tapping problems as the telephone on your desk.

Winter Brothers COMPANY

WRENTHAM, MASS. and ROCHESTER, MICH. • Distributors in Principal Cities

A Division of the National Twist Drill and Tool Company • Branch Stores: San Francisco, Chicago, Detroit

FROM COAST TO COAST

There is a NATIONAL CUTTING TOOL Engineer To Serve You

NATIONAL Service Engineers are strategically located in every section of the country. Factory training and years of experience make them specialists in dealing with all types of problems concerning cutting tools and their uses. One of these engineers is nearby to serve you whenever you need him. His counsel and assistance are at your disposal without obligation. Just call the NATIONAL distributor in your locality.

Craftsmanship **INSURES** *Quality*

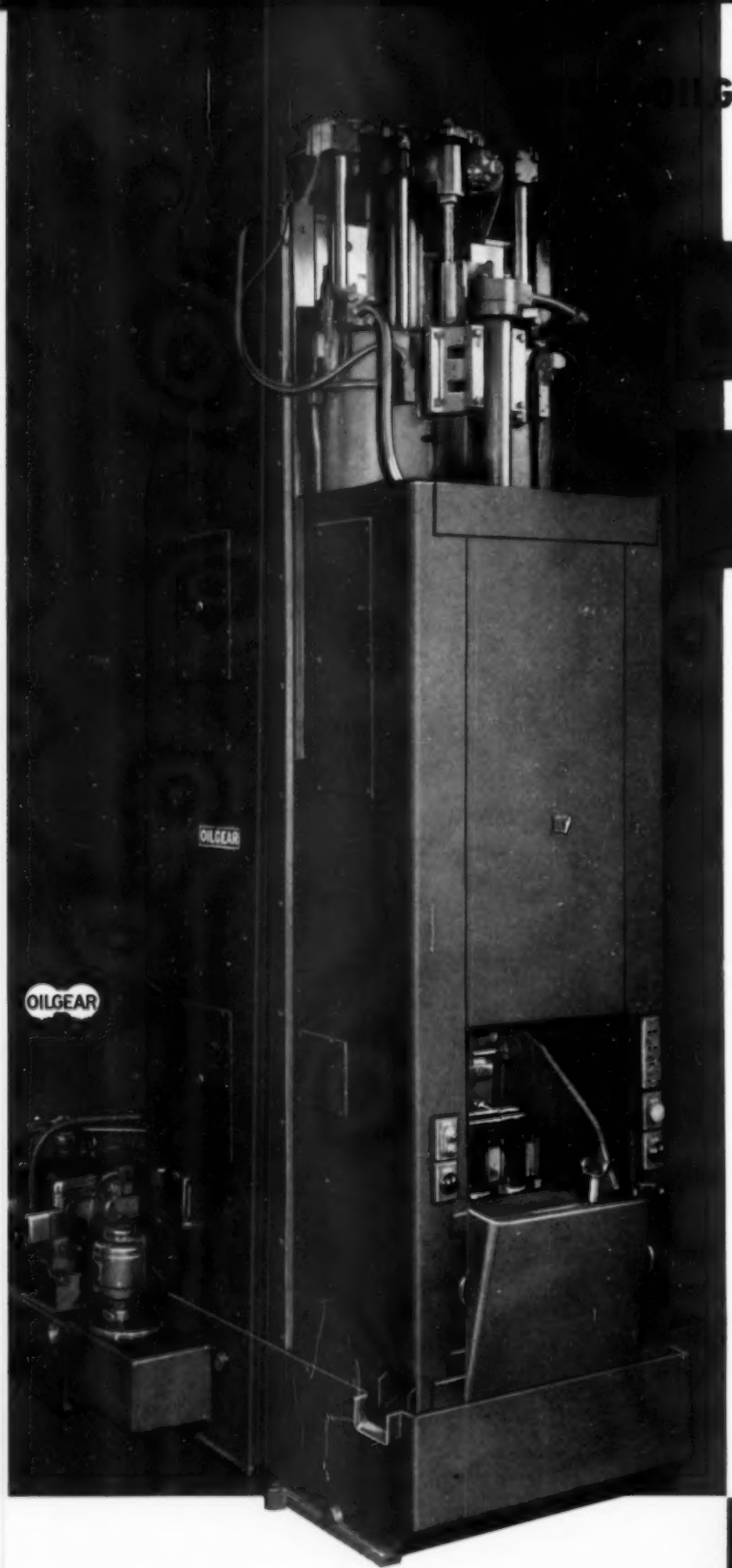
LEADING DISTRIBUTORS EVERYWHERE offer complete stocks of NATIONAL Cutting Tools. Call them for cutting tools or any other staple industrial product.

The skill and facilities to make NATIONAL Tools the best you can buy are supplied at NATIONAL'S great new plant in Rochester, Michigan.

NATIONAL TWIST DRILL AND TOOL COMPANY

ROCHESTER, MICHIGAN, U. S. A. Tap and Die Division — Winter Bros. Co.

Distributors in Principal Cities • Factory Branches: New York • Chicago • Detroit • Cleveland • San Francisco



GEAR NEW VERTICAL CYCLEMATIC BROACHING MACHINES . . .

Holes broached in valve rocker arms 1200 per hour

17 splines broached in universal joint yokes 500 yokes per hour

Work loaded during broaching stroke.
Automatically positioned, threaded, broached, and ejected.

The *unique* Oilgear Vertical Cyclematic Broaching Machine is a *high production* unit. Typically, it finish-broaches 17 splines in universal joint yokes at the rate of 500 pieces per hour, using 3 tools; it finish-broaches holes in valve rocker arms at an average rate of 1200 pieces per hour, using 6 tools. These valve rocker arms are loaded during the broaching stroke.

Work is loaded at a convenient level. Positioning, threading, broaching and ejecting work are entirely automatic. The usual operations, pilot and control valves and other parts that confuse and tire the operator are eliminated. Full manual control of the cycle is provided for test and set-up purposes.

Work table and all controls are designed for utmost ease and convenience to the machine attendant. Dual safety start button, emergency stop button, cycle selector and tool positioning controls are all located in easy reach. Famous Oilgear two-way variable displacement pumps provide variable broaching speeds up to 30 f.p.m. and independently variable return speeds up to 80 f.p.m.

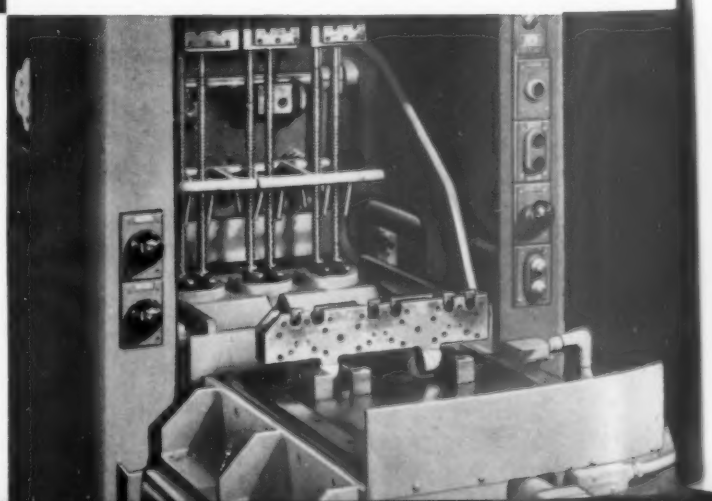
Full pressure lubrication of work and tools is continuous and automatic during the broaching operation and forces chips to fall away immediately. Tools are rigidly secured at both ends during the critical portion of the stroke, eliminating vibration and minimizing drift.

The Cyclematic sets on its own base and requires no special foundation or pit. It can be made a part of a production line without costly preparations and without disrupting operations. Work table height conforms to usual conveyor working level. THE OILGEAR COMPANY, 1308 W. Bruce Street, Milwaukee 4, Wisconsin.

Oilgear Fluid Power
BROACHING MACHINES

See the Oilgear Cyclematic in Action at the Machine Tool Show, Sept. 17-26

At the Machine Tool Show in the Dodge Chicago Plant, September 17 to 26, an Oilgear Type "XM" 30 x 54 stroke Vertical Cyclematic Broaching Machine will be shown in actual operation. ***Be sure to see this high production unit at work.***



3 REASONS WHY... BELTS GRIND & POLISH FASTER - FOR LESS!

✓ **BELTS ARE SHARPER**

✓ **BELTS CUT COOLER**

✓ **BELTS HAVE GREATER CUTTING AREA**

Production increases of 3 and 4 to 1 are the usual result of conversion from abrasive set-up wheels to factory-coated abrasive belts through the use of idler backstands. And the reasons for this margin of improvement are simple engineering facts.

Belt coatings are sharper because each individual abrasive grain on a belt is twice anchored in true cutting position with a uniform, controlled coating of adhesive.

Belts cut cooler because each cutting grain travels a longer orbit between work contacts, thus permitting complete air cooling action at each revolution.

Belts have greater cutting area because of the additional length required for traverse from work wheel to idler pulley, and return.

Let us demonstrate the production improvement of the belt-backstand method in your plant. Our Field Engineers are equipped with portable bench units for just that purpose. Your Industrial Distributor salesman will gladly arrange a convenient date.

BEHR-MANNING · TROY, N. Y.

(DIVISION OF NORTON COMPANY)

Nothing can be

WHAT COULD BE SIMPLER FOR

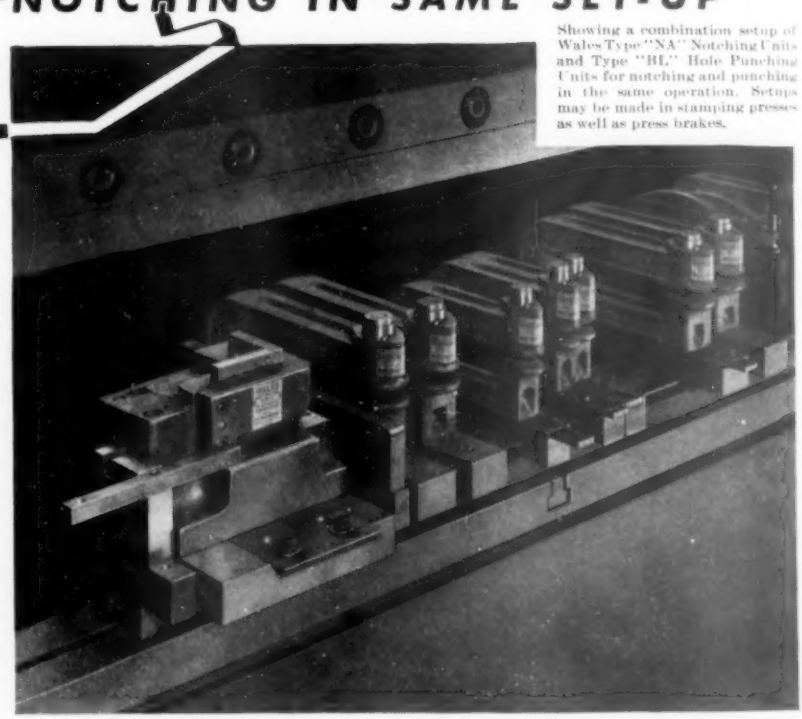
CORNER AND EDGE NOTCHING THAN

WALES NOTCHING UNITS

Showing a Wales Type "NG" Notching Unit equipped with standard side gauges which may be adjusted and set according to required notch.

● So simple in design and operation, Wales Notching Units require practically no setup time. Just place the Units on a T-slotted plate or Template in a stamping press, or on a Bed Rail in a press brake and *start operating*. That's all there is to it *because* all parts are built into the self-contained holder; the punch and die are in perfect alignment; and nothing is attached to press ram. Wales Notching Units are the ultimate in tooling simplicity.

PUNCHING AND NOTCHING IN SAME SET-UP



Showing a combination setup of Wales Type "NA" Notching Units and Type "BL" Hole Punching Units for notching and punching in the same operation. Setups may be made in stamping presses as well as press brakes.

The design of Wales Notching Units also takes into consideration possible use with Wales Hole Punching Units for punching and notching in the same operation. This is just one of the many economies of time and money that are produced with this *versatile* Wales Equipment.

THE SIMPLICITY AND ECONOMIES OF WALES EQUIPMENT IS TOO BIG A STORY TO TELL ON THIS PAGE *SO WRITE FOR FULLY-ILLUSTRATED FUNCTIONALLY-COLORED CATALOGS TODAY*, DESCRIBING 5 STANDARD TYPE OF NOTCHING UNITS.

●

WALES-STRIPPIT CORPORATION • **393 Payne Ave., N. Tonawanda, N. Y.**

GEORGE F. WALES, President (Between Buffalo and Niagara Falls)

WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONTARIO

SPECIALISTS IN PUNCHING AND NOTCHING EQUIPMENT

Talide
(TUNGSTEN CARBIDE)
Performance!

★TALIDE METAL MEETS EVERY REQUIREMENT★

Hardest man-made metal.

Highest modulus of elasticity.

(double that of steel)

Extreme Density.

Low coefficient of expansion and contraction.

High compressive strength.

High red hardness.

On any application involving cutting tools, drawing dies, or wear parts in your plant, you can up your production many times over by using Talide Tungsten Carbide.

For example, cutting tools of Talide cut 2 to 3 times faster than high speed tool steel. Likewise dies and wear resistance parts outwear steel by as much as 50 to 1. Use Talide Metal wherever steel parts wear too fast or service is too severe for steel.

Properly applied, Talide Metal's original cost is no factor as proved by experience of the past 15 years in all types of industrial applications. Let our sales engineers give you full particulars and recommendations.

Send for catalogs on Talide Tools, Dies, and Wear Parts.

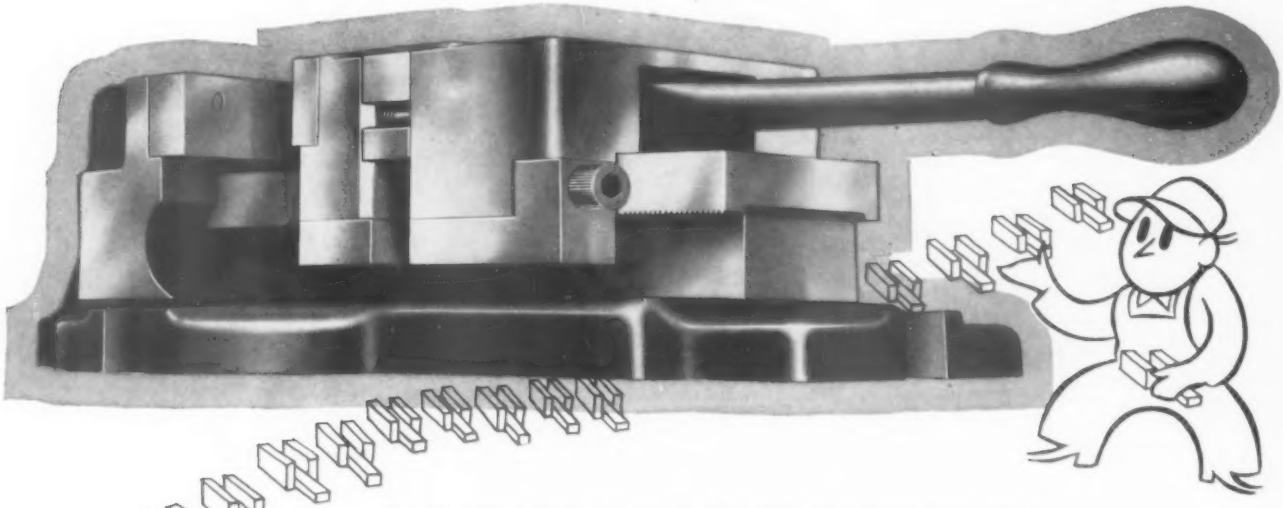
SINTERED CARBIDES
MC
TALIDE
HOT PRESSED CARBIDES

METAL CARBIDES CORPORATION

YOUNGSTOWN 5, OHIO *Pioneers in Tungsten Carbide Metallurgy*

CUTTING TOOLS · DRAWING DIES · WEAR RESISTANT PARTS

SAVE 80% WORK CHANGE TIME, *get more accurate production machining...with Universal Wedge-Lock Production Vise*



You'll *save up to 80% work change time* in your production milling and drilling of parts by using the UNIVERSAL WEDGE-LOCK PRODUCTION VISE. An *easy 15-degree pull* on the locking lever clamps the piece firmly. A second pull of *only 7 degrees* locks it securely, ready for machining. No slow cranking, no multiple levers or complicated gadgets. You'll get *more accurate work*, too, with less spoilage—because the WEDGE-LOCK taper wedge principle distributes clamping pressure *uniformly*, preventing the piece from vibrating or working free under heavy feeds and speeds. Vise jaws and locking wedges are *hardened* and *ground* for maximum durability. Available in 3", 4", 5" and 6" width capacities.

Write for complete particulars.

UNIVERSAL ENGINEERING COMPANY • **FRANKENMUTH, MICHIGAN**

Check These Advantages of CLEVELAND HIGH SPEED COUNTERBORES AND SPOT FACERS

✓ RIGID AND STRONG

The counterbore and spot facer being integral with the shank and the shank being a standard taper, permits the tool to be used directly in the machine spindle, eliminating all holders and adapters.

✓ SIMPLE IN DESIGN

Made of the best grade of High Speed Steel, with no unnecessary or easily mislaid parts.

✓ EXTRA LONG FLUTES

The flutes are extra long, which gives extended life for regrinding and permits the counterboring and spot facing of parts which cannot be reached with a short tool.

✓ TOOL STEEL PILOTS

Pilots are made of the best grade of Carbon Tool Steel, properly heat-treated and ground. They are simple in design, having a straight shank with a flat for the set screw.

Telephone your

INDUSTRIAL SUPPLY DISTRIBUTOR

The CLEVELAND TWIST DRILL COMPANY
1242 EAST 49TH STREET
CLEVELAND 14

TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

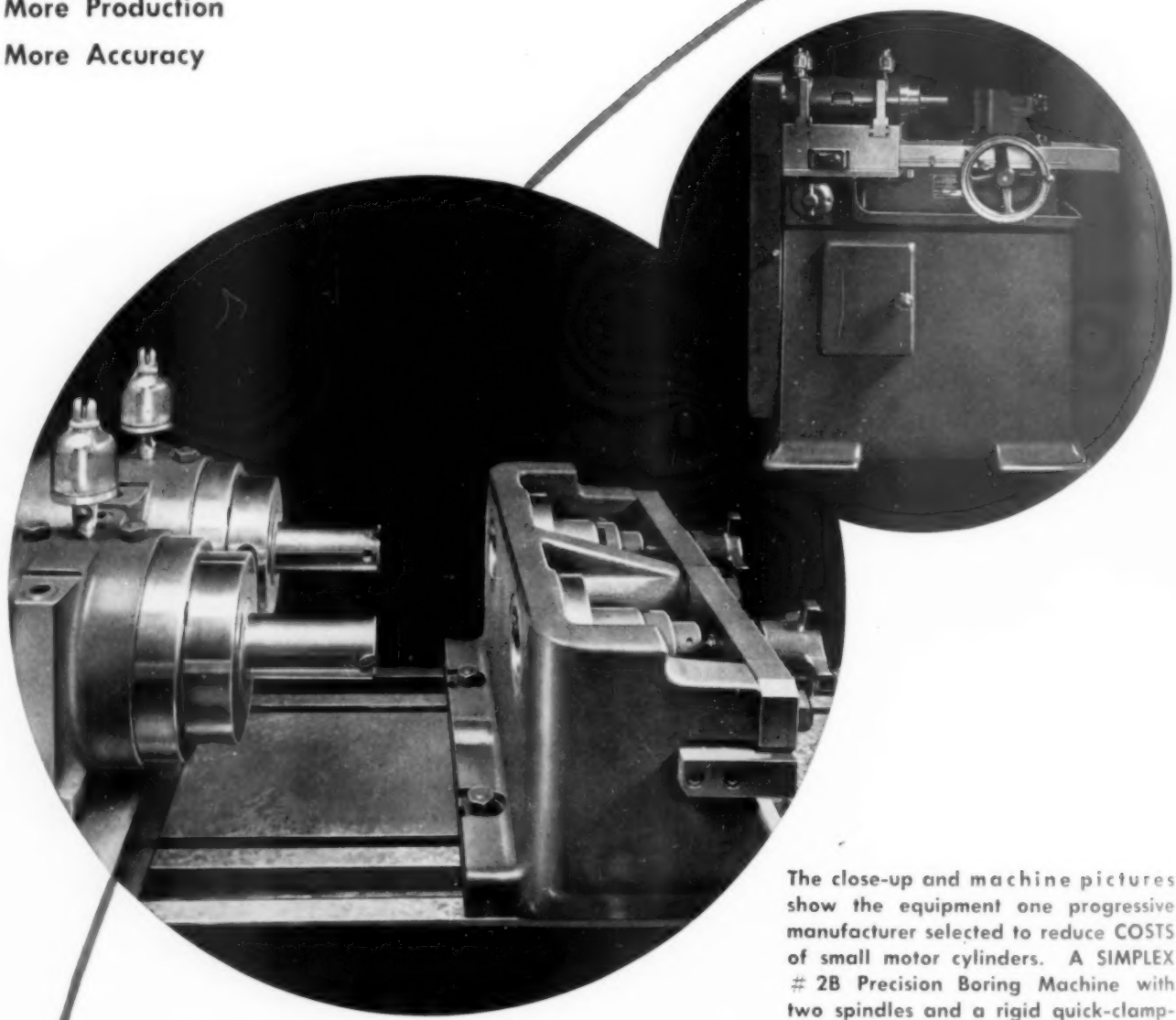
ST. THOMAS ST., NEW YORK 7 • 9 NORTH JEFFERSON ST., CHICAGO 6 • 650 HOWARD ST., SAN FRANCISCO 5
2929 EAST GRAND BLVD., DETROIT 2 • 1902 NORTH FIELD ST., DALLAS 1
E. P. BARRUS, LTD., LONDON W. 3, ENGLAND

"CLEVELAND" DISTRIBUTORS EVERYWHERE ARE READY TO SERVE YOU

SIMPLEX

ELEMENTS OF COST REDUCTION

Low Labor Cost
Low Tool Cost
Low Machine Cost
More Production
More Accuracy



The close-up and machine pictures show the equipment one progressive manufacturer selected to reduce COSTS of small motor cylinders. A SIMPLEX # 2B Precision Boring Machine with two spindles and a rigid quick-clamping fixture provide all the elements of cost reduction listed above.

Precision Boring Machines

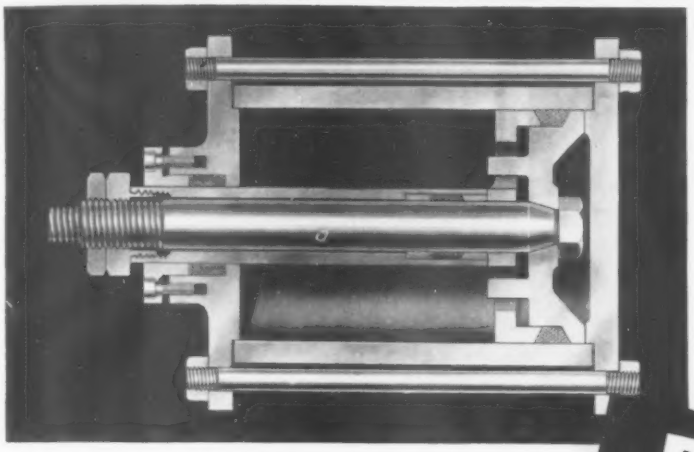
STOKERUNIT CORPORATION
SIMPLEX Machine Tools Division

4528 West Mitchell Street, Milwaukee 14, Wisconsin
Precision Boring Machines, Planer Type Milling Machines and Special Machine Tools

HANNIFIN

Standardized—

to save you TIME and MONEY



THE HANNIFIN line of pneumatic cylinders is complete! For quicker delivery and maximum economy, you can meet virtually any requirement with a standard Hannifin precision-built cylinder.

- —Ten standard bore diameters to choose from, ranging from 1 inch to 12 inch.
- —Six basic mounting styles. Also available in double end styles.
- —Any stroke you specify. Double acting or single acting.
- —With or without adjustable cushioning for head cap . . . rod cap . . . or both.

For the complete story, ask for a copy of Hannifin Bulletin No. 57-J.

PRECISION CONSTRUCTION. Tru-bored from steel cylinder stock. Honed to satin finish by exclusive Hannifin long stroke honing process.

EASY MAINTENANCE. Series "R" cylinders (illustrated above) feature Hannifin's exclusive external adjustment design which permits tightening piston packing without disturbing any internal parts.

"HIGH EFFICIENCY" PERFORMANCE. With Hannifin's graphite-treated piston packing, perfect cylinder finish, and quick, positive adjustment of piston seal, you get a combination that can't be beat for smooth operation . . . low friction loss . . . freedom from air waste!

PNEUMATIC *"leakproof"* CYLINDERS

"Packless" AIR CONTROL VALVES

Good air cylinders deserve good operating valves! For the best, use Hannifin "Packless" Air Control Valves. Complete line of hand and foot operated models. Bronze disc, grounded and lapped with body, makes perfect, long-life, leakproof seal. See Hannifin Bulletin No. 57-H.

HANNIFIN

Nationwide Sales and Service

HANNIFIN CORPORATION

1101 So. Kilbourn Ave., Chicago 24, Ill.

AIR CYLINDERS • HYDRAULIC CYLINDERS • HYDRAULIC PRESSES
PNEUMATIC PRESSES • HYDRAULIC RIVETERS • AIR CONTROL VALVES

Merz Pneumatic Taper Gages

Check taper and out-of-round in single operation

MERZ Pneumatic Taper Gages perform both these vital inspection functions in *one* operation. MERZ Taper Gages—in models to fit all your inspection requirements—consist of two MERZ Air Gages, plus a special fixture equipped with large and small hard steel taper-gaging rings. One air gage registers taper variations to plus or minus 30′, in graduations of 5′. (Also available for totals of plus or minus 10′ in graduations of 1′). Out-of-round conditions up to .002 are registered simultaneously on the second gage in increments of .0001. MERZ Pneumatic Taper Gages are fast, accurate, durable and dependable. Write for complete information.

MERZ also manufactures a standard line of pneumatic gages in five models, as well as standard A.G.D. and special gages.

MERZ *Engineering Company*
INDIANAPOLIS 7, INDIANA

Grand Rapids No. 4 Universal Cutter and Tool Grinder

The extreme flexibility and versatility of the Grand Rapids Universal Cutter and Tool Grinder makes ordinarily complicated grinding operations really practical, convenient, simple and fast.

Write for Bulletin 1045

GALLMEYER & LIVINGSTON COMPANY
Manufacturers of Grand Rapids Grinders
110 STRAIGHT ST., S. W., GRAND RAPIDS 4, MICH.

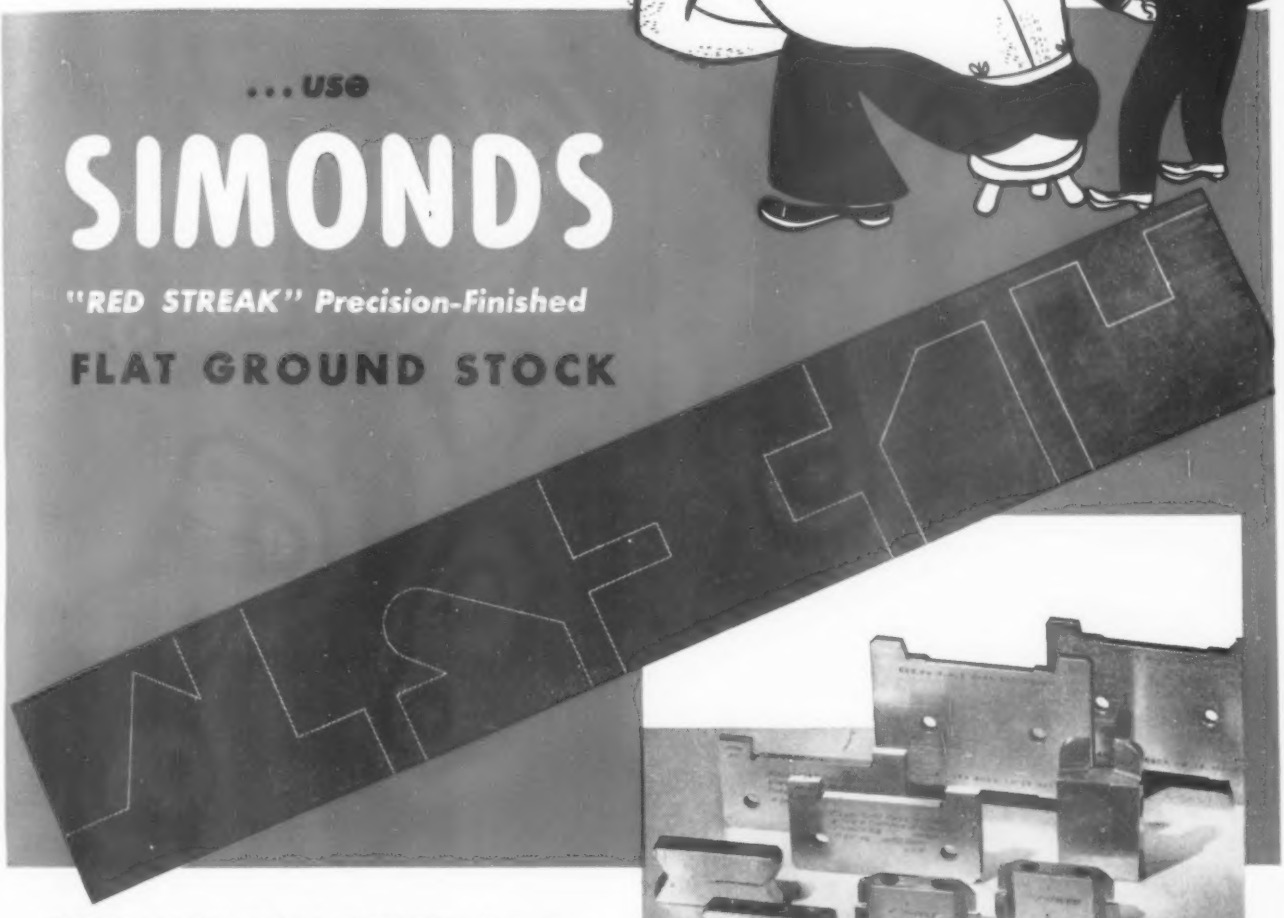
Get SMOOTH SURFACES for Accurate Layout Work

...use

SIMONDS

"RED STREAK" Precision-Finished

FLAT GROUND STOCK



MAKE YOUR OWN GAUGES, dies, jigs, templates, stamps, shims, machine parts and small tools . . . with Simonds Oil Hardening Flat Stock, made of Simonds own alloy tool steel, uniformly annealed for easy machining and proper hardening.

SAVE TIME AND MONEY with this Flat Stock which is cut to 18″ length and accurately ground to standard thicknesses and widths. *No need for the expensive machining required to grind ordinary stock to size.*

145 STOCK SIZES . . . special sizes to order. Get "Red Streak" Flat Ground Stock from your Simonds distributor, or the nearest Simonds office. Immediate delivery from stock.

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

Other Divisions of SIMONDS SAW AND STEEL CO. making Quality Products for Industry

SIMONDS STEEL MILLS — SIMONDS SAW AND STEEL CO., LOCKPORT, N.Y. — *Special Electric Furnace Steels*

SIMONDS ABRASIVE CO. — PHILADELPHIA, PA. — *Grinding Wheels and Grains*

SIMONDS CANADA SAW CO. LTD. — MONTREAL TORONTO VANCOUVER SAINT JOHN, N.B. — *Simonds Products for Canada*

BRANCH OFFICES: 1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Calif.; 228 First St., San Francisco 5, Calif.; 311 S. W. First Avenue, Portland 4, Ore.; 31 W. Trent Ave., Spokane 8, Wash. *Canadian Factory:* 595 St. Remi St., Montreal 30, Que.

ON RED-E
BALL BEARING CENTERS

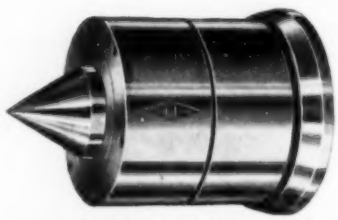
Working with carbide or high speed steel cutting tools? Need live centers that will stand up under continuous operation and maintain more accurate, faster output?

Shank Type

Ball and Roller Bearing Type

If so, you'll want these new, free Bulletins in your file for ready reference to RED-E New Departure Ball Bearing CENTERS. Detailed descriptive material, valuable engineering data . . . complete information to aid in selecting *precision* centers to meet your *precision* machining requirements.

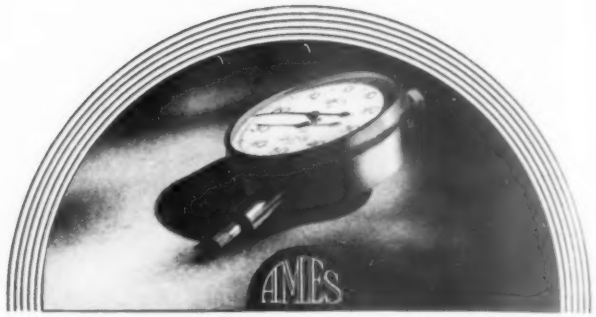
Copies of Bulletins 471 and 472 will be mailed promptly on request. Write — Department TE.



Outside Spindle Type

CENTER Specialists Since 1908

RED-E-TOOLS
THE READY TOOL COMPANY
550 Iranistan Ave., Bridgeport 5, Conn.

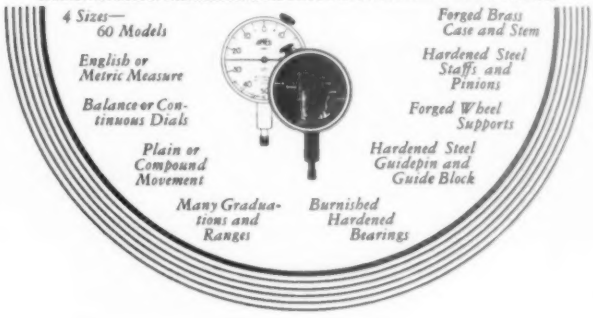


WHEN MEASURING IS YOUR PROBLEM...

AND your requirements combine high standards of accuracy, long service-life, and the greatest possible economy of operation—you'll find the answer in AMES' complete line of *quality* Micrometer Dial Gauges and Indicators. Instruments that are *on the job* the world over—solving the complex measuring demands of modern industry. Send us *your* problem today.

Representatives in principal cities B. C. AMES CO. *30 Ames Street Waltham 54, Mass.*

MANUFACTURER OF MICROMETER DIAL GAUGES AND MICROMETER DIAL INDICATORS



A WHOLE SHOPFULL OF TOOLS IN ONE

Machinist - craftsmen find it unsurpassed for grinding, drilling, routing, carving, sanding, polishing and 9,994 other uses. Precision-engineered, AC - DC, with more exclusive features than any other tool.

Exclusive finger-grip brings hand closer for finer work

Complete with 36 accessories in fitted steel case

$22.50

$32.95 value if purchased separately

CASCO Electri-Craft Tool Kit

CASCO PRODUCTS CORPORATION • BRIDGEPORT 2, CONN.

Get Your Copy

Send now for this handy booklet showing the complete line of Gairing standard tools.

These and many more, the whole line of standard cutting tools made by GAIRING, are now completely described and shown in the new *Gairing Standard Tool Catalog.*

All these are tools of general application, made in standard designs and generally available from stock. All are based on the economy principle of interchangeable cutters and some of them have been made by us for as long as thirty years.

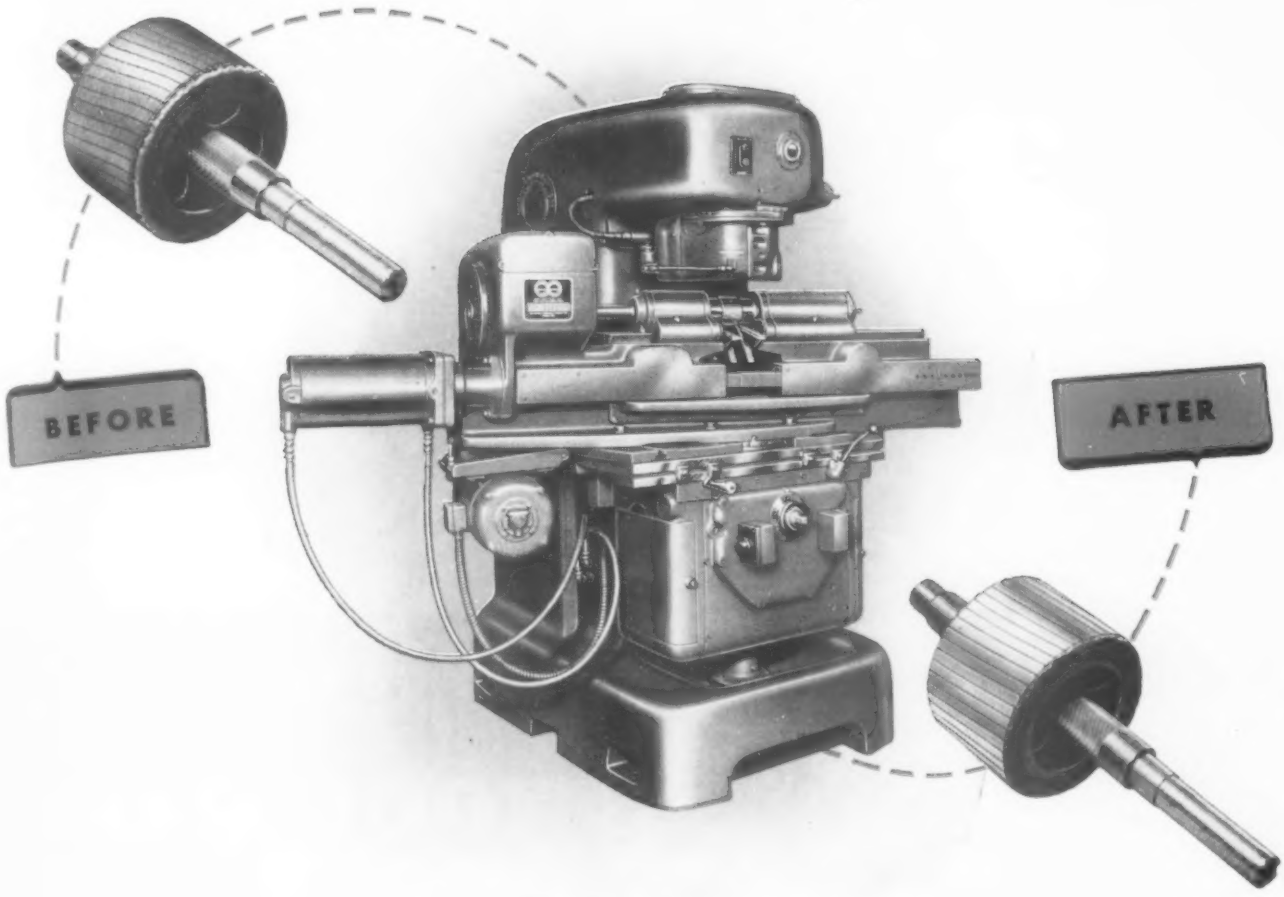
Completely catalogued are: interchangeable counterbores, threaded holders, full floating holders, tungsten carbide tipped counterbores, back spotfacers, core drills, micro-nuts and hollow mills. A few pages are devoted to an introduction of the block-type boring tools and some of the more generally used special tools like multi-diameter cutters, carbide-tipped cutters and milling cutters.

30th

THE GAIRING TOOL COMPANY

21223 Hoover Road
Detroit, Michigan

A *Better Way* TO FINISH ELECTRIC MOTOR ROTORS



Turning and grinding the rotor laminations of an electric motor will bring it within run-out tolerance, but it will also smear and close the laminations as well as burr the bar slots. Where efficiency is a factor, a final operation is necessary to open these slots.

Now, there is a new, quicker, better and less expensive way to finish rotors from the rough to close tolerance. The new Red Ring Rotor Shaving Machine Rotoshaves the rotor with a fine pitch precision cutter operating at high speed and on an angle to the axis of the rotor. The result is less machine time, good accuracy and no smearing of the laminations or burring of the bar slots.

A typical case is a 3¼" diameter by 2" face rotor completely finished in one pass (16 seconds) with .030" of stock removed on the OD and to a tolerance of .002" or less. Loading time is 4 seconds. 2598

Write for information based on your own requirements.

RED RING PRODUCTS

NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

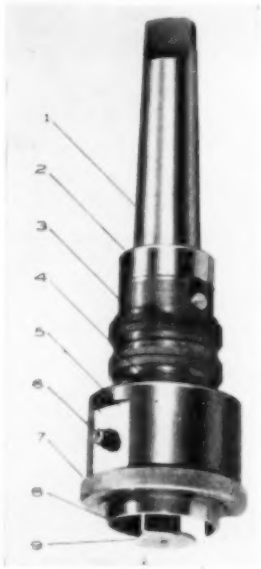
SPECIALISTS ON SPUR AND HELICAL INVOLUTE GEAR PRACTICE • ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

Recessing Tools . . .

for GROOVING, RECESSING, BACK FACING

Adaptable to Drill Press, Boring Mill, Turret Lathe, Automatic, Milling Machine, etc.

1—SHANK—to fit your machine, threaded to driving sleeve.
2—DRIVING SLEEVE—A sliding fit to body shank.
3—STOP COLLARS—Adjust to control travel of cutter.
4—BODY.
5—CUTTER BLOCK—Travels in 1 to 1 ratio and at right angle to sleeve.
6—COOLANT HOLE—Permits flow of coolant or lubricant to cutter.
7—PILOT RETAINING COLLAR—Holds ball bearing pilot assembly to body.
8—PILOT—Made to your specifications, permits rotation of tool or work.
9—CUTTER—Made to your specifications for material and work piece.

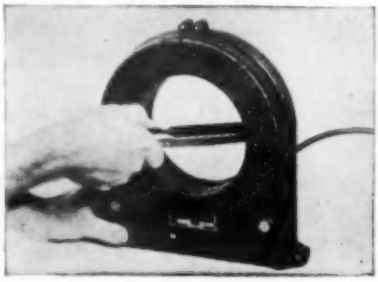


Cuts one or more grooves any shape or form. Takes cuts at unusually high feeds

No. 1—Cap. ⅝" to 1" Hole; Std. Shank, No. 3 Morse
No. 2—Cap. 1" to 2" Hole; Std. Shank, No. 4 Morse
No. 3—Cap. 2" to 3" Hole· Std. Shank, No. 5 Morse
No. 4—Cap. 3" to 4" Hole; Std. Shank, No. 5 Morse

Demagnetizers . . .

for easy demagnetizing of tools or parts



Just pass the tool or part through the opening of a 6" "Through Type" Demagnetizer and remove to a distance of one or two feet, before turning off the current. To speed up production, work can be dropped through by gravity. Operates on 110 volts—60 cycles. No moving parts. Other standard sizes from 4" x 24" to 18" x 24".

PRECISION PRODUCTION TOOLS

PROMPT DELIVERY

Write for Literature

ACME TOOL COMPANY

17 WEST BROADWAY NEW YORK 7, N. Y.

ARMSTRONG *Carbide* TOOL HOLDERS

for Higher Speeds, and Heavier Feeds

ARMSTRONG Carbide Tool Holders and ARMIDE (Carbide Tipped) Cutters come in cased sets for tool rooms and maintenance departments, and individually in all sizes for general machine shop and production turning. They permit not only the ready machining of sand-filled castings, the hardest and toughest steels as well as many heretofore "unmachineable" materials, but also make practical much heavier cuts and cutting speeds up to 600 f.p.m. on ordinary work. They also run from 10 to 100 times as long between regrindings.

Write for ARMSTRONG Carbide Bulletin

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

357 N. Francisco Ave., CHICAGO, U. S. A.

NEW YORK SAN FRANCISCO

Columbia TOOL STEEL

MORE FOR LESS—

More chips per grind, more blanks per die, more production per dollar with Columbia Tool Steels.

COLUMBIA TOOL STEEL COMPANY

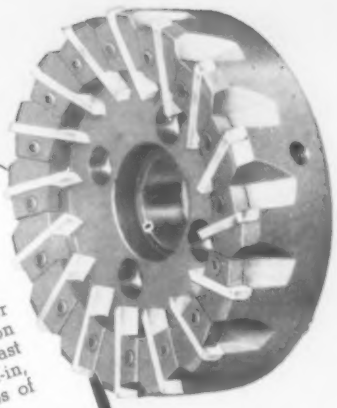
ARTHUR T. CLARAGE, PRESIDENT

MAIN OFFICE AND WORKS

520 EAST 14TH STREET • CHICAGO HEIGHTS, ILL.

"Universal" Face Kennamill

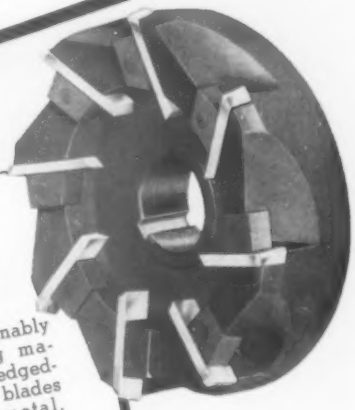
For high rate face milling on reasonably modern machines. Has wedged-in, advanceable blades of solid Kennametal. Adaptable for milling different materials by interchanging blades.



"CF" Face Kennamill

Specially designed for maximum efficiency on repetitive jobs on cast iron. Has wedged-in, advanceable blades of solid Kennametal.

IT PAYS *to know your* KENNAMILLS

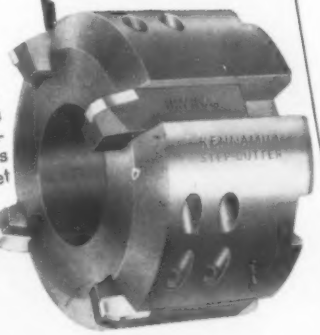


Half-Side Kennamill

For use on reasonably modern milling machines. Has wedged-in, advanceable blades of solid Kennametal. Adaptable for milling different materials by interchanging blades.

Axial Face Kennamill

For wide or deep cuts—straight, chamfer, or form—in one pass. Has Kennametal-tipped blades held in position by set screws.



Step Kennamill

For efficient carbide milling on milling machines of capacity as low as 1 H.P. Has Kennametal-tipped blades held in position by set screws.

Kennamilling is a new technique that enables you to obtain maximum production from existing milling machines, and to realize to the fullest extent the output inherent in the latest models.

This technique is the outcome of many years of research and experimentation by Kennametal engineers in cooperation with machine tool builders and manufacturing companies.

The Kennamills illustrated are the efficient "cutting heads"—behind them lies accumulated experience and "know-how" that is of great assistance in helping you to achieve the greatest benefits from negative rake carbide milling. Let us prove this on one of your jobs. Our representative in your district will be glad to demonstrate.

KENNAMETAL

SUPERIOR CEMENTED CARBIDES

KENNAMETAL Inc., LATROBE, PA.

BOYAR-SCHULTZ PROFILE GRINDERS

Fast, Accurate CONTOUR GRINDING

IN THE TOOL ROOM ... IN PRODUCTION

Boyar-Schultz Profile Grinders save time in grinding inside and outside contours, irregularly shaped profiles, die clearances and many other difficult grinding tasks.

Boyar-Schultz No. 2 Profile Grinder—A heavy duty floor model available with single or dual spindles which turn at 10,000 R.P.M. with vertical oscillations. Rapid stock removal even with wheels as small as ½" diameter. Uses wheels ½" to 3".

Boyar-Schultz No. 1 Profile Grinder—Bench model. Spindle speed of 20,000 R.P.M. with vertical oscillations. Accommodates wheels ⅛" to 1" diameter. A highly efficient tool that performs in minutes, much of the work that formerly required hours.

BOYAR - SCHULTZ CORPORATION
2104 WALNUT ST. CHICAGO 12, ILLINOIS

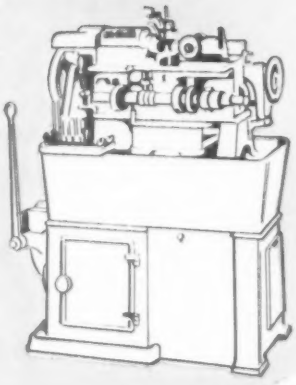
BAY STATE TAPS & DIES

The Home of Bay State is designed for manufacturing Tap and Dies of Precision Performance. ★ Standard Quality makes them a Quality Standard. *On nearby shelves of Industrial Supply Distributors.*

BAY STATE TAP & DIE CO.
MANSFIELD, MASSACHUSETTS

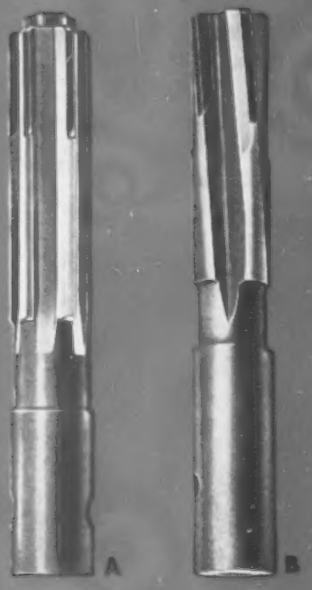
TOP PRODUCTION TEAM

for HIGH Accuracy and LONG Runs



AUTOMATIC SCREW MACHINES . . . . . PLUG . . . . . CARBOLOY-TIPPED (CEMENTED CARBIDES)

STUB SCREW MACHINE REAMERS



Staples stub screw machine reamers cut production costs on automatic screw machine operations by eliminating frequent down time for reamer sharpening. Carboloy surfaces are highly resistant to wear—far exceed H.S.S. on tool life. Tools hold accurate diameters, permitting long runs on exceptionally close tolerance work.

These reamers are made both in solid and expansion types. Tools are stocked semi-finished and are ground to size specified with tolerance of .0003" on diameter. A complete range of sizes is available for immediate delivery.

(A) Staples Carboloy - tipped Expansion Stub Screw Machine Reamer,

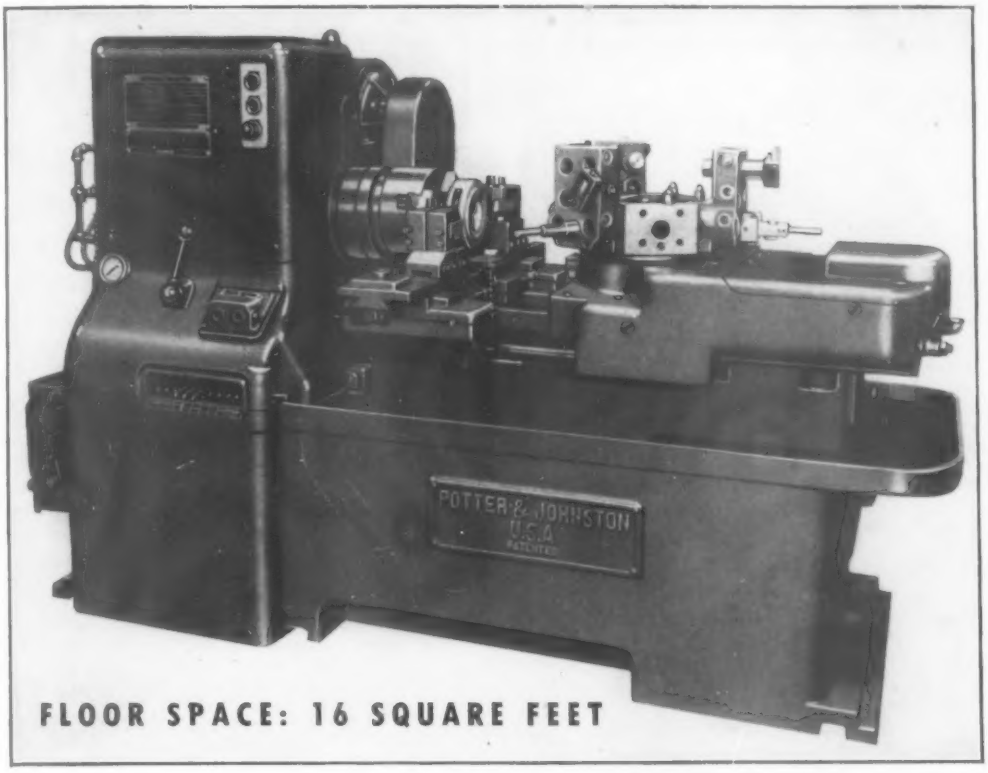
Staples patented expansion principle permits easy adjustment of tool to .0001". Expansion plug limited to $^{3}/_{32}$" extension beyond tool end (width of cut-off blade) eliminates possibility of plug striking bottom of drilled hole. Can also be furnished with plug flush with tool end if specified.

(B) Staples Carboloy - tipped Solid Stub Screw Machine Reamer.

THE STAPLES TOOL COMPANY
CINCINNATI 25, OHIO
Distributors in Major Cities

Staples CARBOLOY-TIPPED CIRCULAR CUTTING TOOLS

REAMERS • CORE DRILLS • SPOT FACERS • COUNTERBORES • END MILLS • SHELL END MILLS • ALSO A COMPLETE LINE OF CIRCULAR SPECIAL TOOLS



FLOOR SPACE: 16 SQUARE FEET

Versatility of Tooling

The Potter & Johnston new 3-U Speed-Flex Automatic Turret Lathe, with its power and high speed demanded by carbide tooling, is characterized by the versatility of its tooling. It can be set up to perform a single operation, or multiple operations simultaneously. *The machine makes a complete cycle of operations in 24 seconds!* It has 48 changes of speed arranged in six sets of four automatic changes; Lowest 36 R.P.M., Highest 1445 R.P.M. It has 24 feeds arranged in geometric progression from .0023 to .0684, or from .0042 to .125 per spindle revolution. All the innovations and improvements built into the new 3-U are designed to improve the quality of the production, and at the same time cut the cost per piece. In the final analysis, this is the main function of the machine—and if you are about to select machines for your production line, we respectfully suggest that you consider the advantages offered by this latest P. & J. development, the 3-U Speed-Flex Automatic.

P&J

POTTER & JOHNSTON MACHINE CO., PAWTUCKET, R.I.

INGERSOLL *Shear Clear*

Carbide Tipped **FACE MILLS FOR HIGHER FEED RATES MILLING**

• Iron • Aluminum • Steel

The Ingersoll patented Shear Clear face mill is now available with special angles for milling either cast iron, aluminum, or even steel with carbide tipped blades. It is now possible to mill steel with positive angles using carbides if there is sufficient rigidity in machine and fixture.

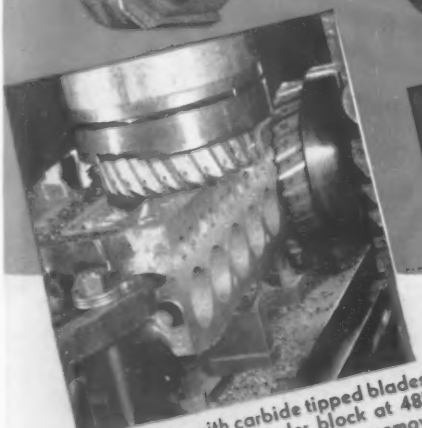
Carbide cast iron Shear Clears are now milling cylinder blocks, crank cases, transmission cases, flat irons, etc., at feed rates up to 48" per minute, and special cutters can be designed for higher feed rates if power is available.

Feed rates and cutting speed are almost unlimited with Ingersoll carbide tipped Shear Clears milling aluminum. Machine rather than cutter is limiting factor.

The steel carbide Shear Clear is particularly intended for rough and finish cuts on steel weldments. The unique combination of cutting angles controls chip flow and protects entering angle to maintain cutting edges on carbide tip.

Write for Catalog No. "55C" describing these and other Ingersoll inserted blade milling cutters with high speed steel, cast alloy, or carbide tipped blades.

THE INGERSOLL MILLING MACHINE CO., ROCKFORD, ILLINOIS

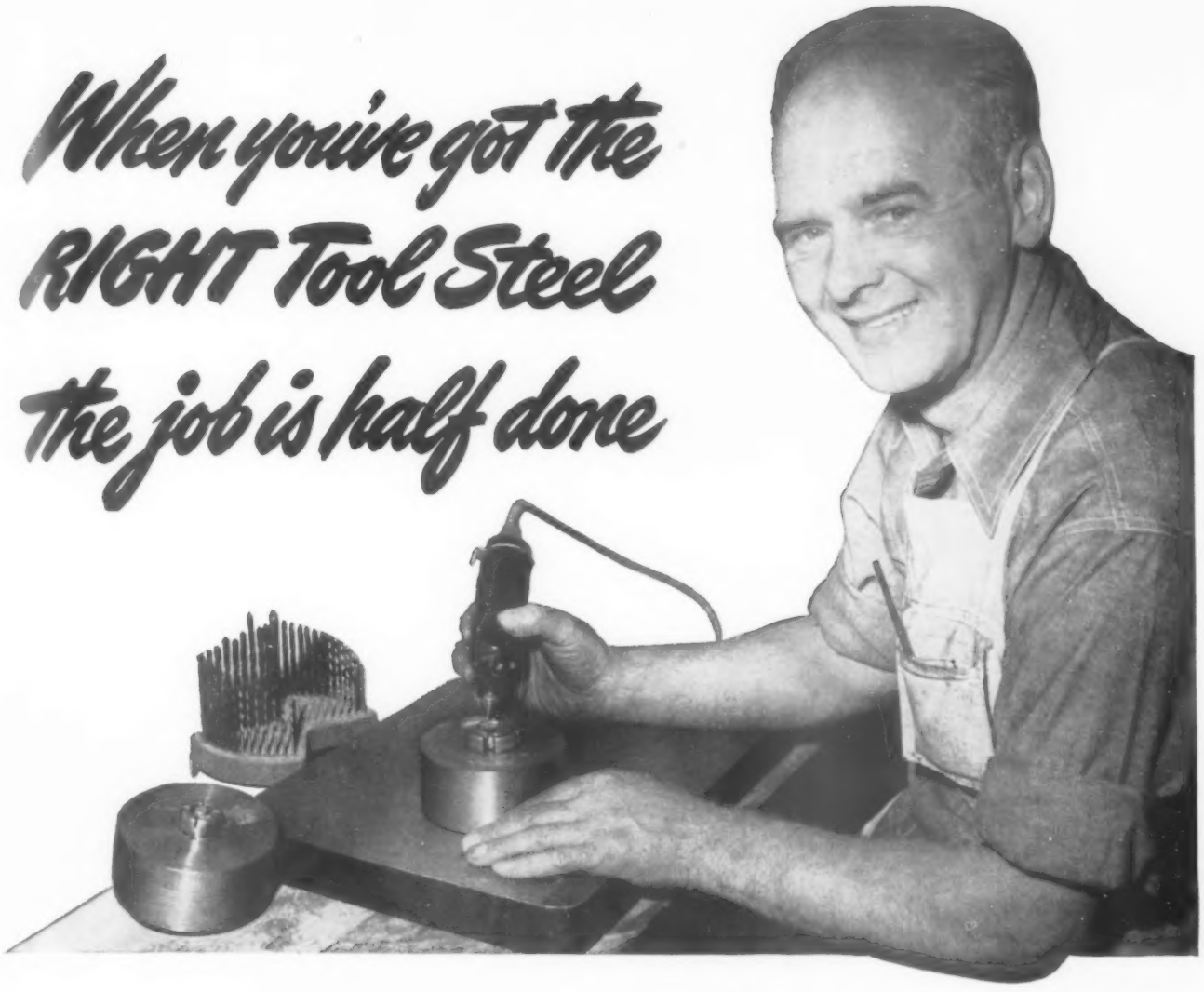


Shear Clears with carbide tipped blades milling cast iron cylinder block at 48" per minute feed, 275 ft./min., removing 1/8–3/16" stock.

Note how Shear Clear chip is forced to coil out along the blade away from finished surface and is thrown clear of cutter at end of cut. This action produces smoother finish, faster feeds, longer tool life, and less power requirements.

Milling SAE 2330 test block with 10" diameter Carbide tipped Shear Clear. 3/4" stock, 8" wide cut, 300 ft/min., 16" feed, 105 horsepower.

When you've got the RIGHT Tool Steel the job is half done



It often happens that a tool-maker has used a certain brand of steel for years, with good results. So he swears by this brand, and will assure you that it is positively the best that money can buy.

But then one day he uses this steel for a job that is just a little different from any previous job . . . and it is a complete failure. He just can't believe it, first . . . then he's puzzled. As he thinks it over he decides that the trouble lies in the heat-treatment, the design . . . or even in his own workmanship. So he tries again. And again the result is failure. Finally he admits, reluctantly, that his trouble came from using the wrong steel. The steel itself was good enough, but it just wasn't suited for that particular job.

Choose your tool steel carefully for each different application. It pays. And remember that no one tool steel can possibly cover a wide range of tool and die jobs. But there are five distinct grades of Bethlehem Tool and Die steels that cover most requirements:

CARBON Tool Steels—for general-purpose tools

BTR (Bethlehem Tool Room)—a safe-hardening tool and die steel

BA-H (Bethlehem Air-Hardening)—a die steel for minimum distortion

LEHIGH H TEMPER—a die steel for maximum production

OMEGA—engineered for shock-resisting applications

Selecting the right steel for every job is not always easy. That's why Bethlehem's staff of metallurgists is at your service to help you solve tool steel problems. Plan now to take advantage of this complete tool steel service. Just call the nearest Bethlehem district office or distributor for full details.

BETHLEHEM'S *Complete* TOOL STEEL SERVICE

PROMPT DELIVERY

TOOL STEELS for EVERY JOB

METALLURGICAL ASSISTANCE

Distributors and offices everywhere

★ BETHLEHEM STEEL ★

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

MICROMATIC

MECHANICAL MICROHONER MACHINE

Model 717

New

THE full benefits of Microhoning accomplishment for salvage, tool room and semi-production work are provided in this new all-mechanically actuated machine. It is designed to Microhone to desired standards a wide variety of types and sizes of bores from ½ to 4-in. in diameter up to 7-in. maximum lengths, with a minimum number of tools and fixtures.

It is small and compact, but sturdily built. The table is integral with the cast iron base; the head is adjustably supported on a round, rigid column providing accurate alignment.

Full working usefulness of the adjustable, positive stroke is assured by an extra manual lift-out stroke. Cost of tooling is minimized, and complete operator control of tool expansion is possible because the adjusting head is mounted on, but does not rotate with the spindle.

Adaptability to parts of any material or type within the size range is assured by selection from six rotation and four reciprocation speeds.

Standard electrical equipment is located for quick service and maintenance accessibility.

Specifications

- For bore diameters . . . . . ½ to 4-in.
- For bore lengths . . . . . Up to 7-in.
- Stroke . . . . . 6-in.
- Liftout . . . . . 3½-in.
- Spindle to table, max. . . . . 24 11/16-in.
- Spindle to table, min. . . . . 7-in.
- Spindle to column . . . . . 11-in.
- Rotation speeds, r.p.m.
  1058-742-505-334-234-159.
- Spindle reciprocations per min.
  278-139-93-69.

See this and eight other new model Microhoning machines at National Machine Tool Builders' Show, Chicago, September 17-26, 1947.

BOOTH 323

MICROMATIC HONE CORPORATION

DETROIT 4, MICHIGAN

MACHINES • TOOLS • FIXTURES • ABRASIVES

LOS ANGELES, CALIF. • HOUSTON, TEXAS • ROCKFORD, ILL. • NEW HAVEN, CONN. • BRANTFORD, ONT.

Cut Machining Cost per Piece!

Get increased production from your present turning, boring and facing facilities by changing to Improved TECO Cemented Carbide. Costs go way down because your machines give longer continuous operation—produce considerably more pieces between grinds—save much of the down time now wasted on frequent tool changing.

Based upon Improved TECO's remarkable records in other plants, your own production should show similar increases per tool, per machine. It's worth investigating . . . and easy to prove. Run a few machines equipped with Improved TECO on any carbide job. Compare pieces per grind, grinds per tool, tool life, tool cost with former carbides. Then check TECO's unusual ability to operate at higher speeds and feeds.

Our tool engineers are glad to discuss your needs. Or, send us details of your machining problems for recommendation. Catalog and price list sent on request.

TUNGSTEN ELECTRIC CORPORATION
570 39th STREET, UNION CITY, N. J.
Branch Office: 403 Western Reserve Bldg., Cleveland 13, Ohio
Representatives: Indianapolis, Ind., Detroit, Mich.

Improved
TECO
CEMENTED CARBIDE

TECO TOOLS and BLANKS
for prompt shipment
Wide range of sizes and styles for most machining needs.

• more pieces between grinds
• more grinds per tool • less down time
• lower tool cost

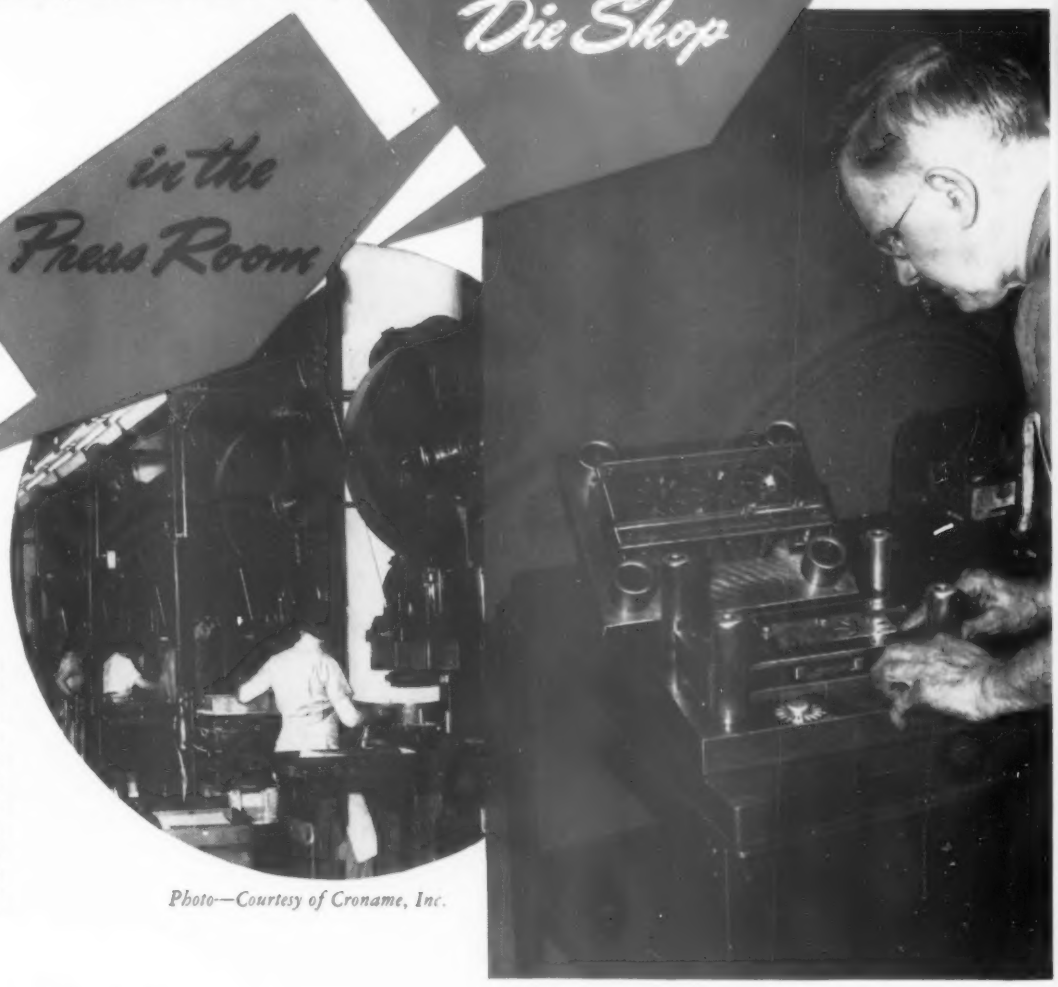
Danly Die Sets and Die Makers' Supplies Speed Production

in the Die Shop

in the Press Room

DANLY PRECISION DOWEL PINS are accurate through their entire length . . . Diamond tested for hardness (58-60 Rockwell-C) . . . Ground to a tolerance of .0001".

DANLY KNURLED SOCKET-HEAD CAP SCREWS save time and money. The mechanic can drive the knurled head a good part of the way before using the wrench. Infinite applications—a wide range of sizes.

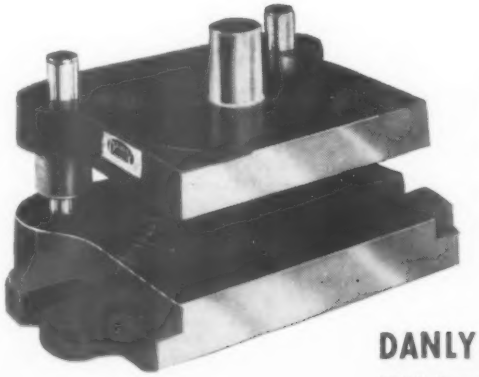


Photo—Courtesy of Croname, Inc.

DANLY KWIK-KLAMP TOGGLE CLAMPS combine strong construction and simplicity of operation—used wherever quick, positive clamping action is required.

DANLY DIE SPRINGS are noted for staying power and high resistance to fatigue. Two complete lines: *Medium Pressure—High Deflection; High Pressure—Medium Deflection.*

DANLY SOCKET-HEAD STRIPPER BOLTS. Made of high-grade steel, these stripper bolts have the same knurled socket-head found in Danly Cap Screws.



DANLY DIE SETS are famed for precision and known accuracy in Die Shops and Stamping Plants everywhere. Many types and sizes in Steel, and Semi-Steel.

DANLY *National Assembly*

Call Danly

- MILWAUKEE 2 — 111 East Wisconsin
- DETROIT 16 — 1549 Temple Avenue
- CLEVELAND 14 — 1550 East 33rd Street
- DAYTON 2 — 990 East Monument
- ROCHESTER 4 — 16 Commercial Street
- PHILADELPHIA 44 — 18 W. Chelten Avenue
- LONG ISLAND CITY 1 — 47-28 37th Street
- DUCOMMUN METALS & SUPPLY CO. — 4890 South Alameda, Los Angeles 54

DANLY MACHINE SPECIALTIES, INC.

2100 South 52nd Avenue • Chicago 50, Illinois

Danly Tool, Die and Gage Makers' Supplies

Index of Tool Engineer Advertisers

July 1947

EX-CELL-O CYLINDER BORING MACHINES

Boring as a method of precision machining automotive cylinders is a pioneer development by Ex-Cell-O. Here is shown the latest Ex-Cell-O machine of this type, Style 66 Vertical. Can be used also for boring holes in other parts where accuracy of roundness and straightness is required. *See it at the Show!*

NEW IMPROVED THREAD GRINDER

This new Ex-Cell-O Style 35-A Precision Thread Grinder is hydraulically operated and electrically controlled. Accommodates single or multi-rib wheels, with diamond dressers or form crusher. Leads from 1 to 128 threads per inch obtained with standard change gears. *See it at the Show!*

***Automatic* TOOL GRINDER**

Designed for fast conditioning of straight faces of carbide-tipped, stellite, and high speed steel cutting tools. Ex-Cell-O Style 40 Automatic Grinder is extremely economical for the conditioning of varying quantities of identical tools. *See it at the Show!*

XLO

EX-CELL-O for PRECISION

47—26

EX-CELL-O CORPORATION DETROIT 6 MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • CONTINENTAL CUTTING TOOLS • MISCELLANEOUS PRODUCTION PARTS
FUEL INJECTION EQUIPMENT • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • DAIRY EQUIPMENT

thread checking time and costs Reduced!

Only two instruments are required in many plants to solve external thread checking problems—Sheffield's new Adjustable Leadchek and the Sheffield Visual Gage with thread checking accessories. Checking is quick, accurate and inexpensive.

Write for detailed information on these instruments—and for other thread gages not illustrated.

1 **NEW ADJUSTABLE LEADCHEK** for range of 4½ to 60 threads per inch and for work up to 2" in diameter, equipped with a "tenth" dial indicator for production use or with an "Electrigage" for the toolroom where tolerances are as close as .0001". Write for Inst. No. 27.

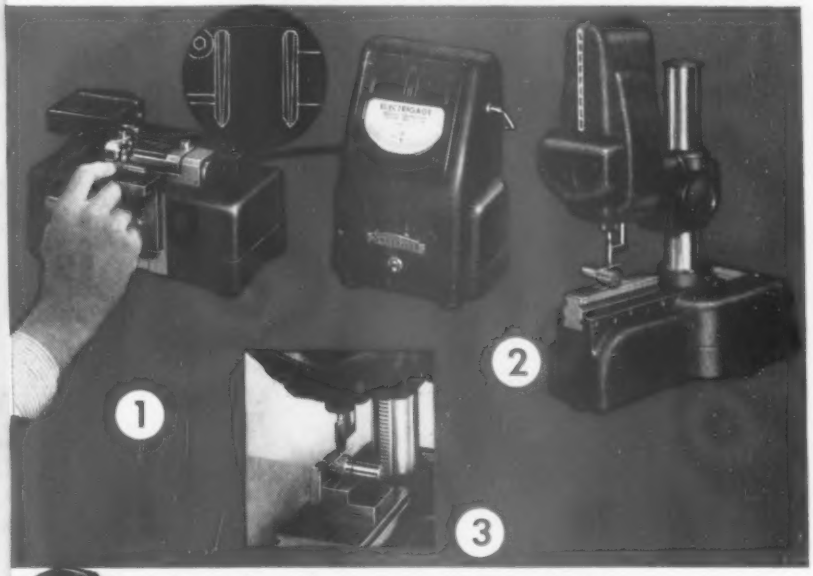
2 **VISUAL GAGE** with thread checking attachment for three wire checking of PITCH DIAMETER. Write for VG-500-45.

3 **SINE BLOCK** used with Visual Gage for checking MAJOR DIAMETER, PITCH DIAMETER and TAPER of tapered pipe threads up to 3" in diameter. Write for VG No. 4.

4 **VISUAL GAGE** with Ball Point Accessory for a rapid 2-point check of PITCH DIAMETER of parts up to 1" nominal diameter and with an accuracy comparable to the three wire method. Parts up to 2" can be handled with larger accessory. Write for VG No. 2.

5 **THREADCHEK** for the rapid inspection of LEAD, PITCH DIAMETER, THREAD ANGLE, ROUNDNESS, TAPER and STRAIGHTNESS, especially for studs, bolts and other threaded elements produced in large volume. Write for Inst. No. 10.

Accuracy in the toolroom



Speed with accuracy in production

Chek with SHEFFIELD on thread inspection equipment

the Sheffield corporation

2587

Dayton 1, Ohio *U. S. A.*

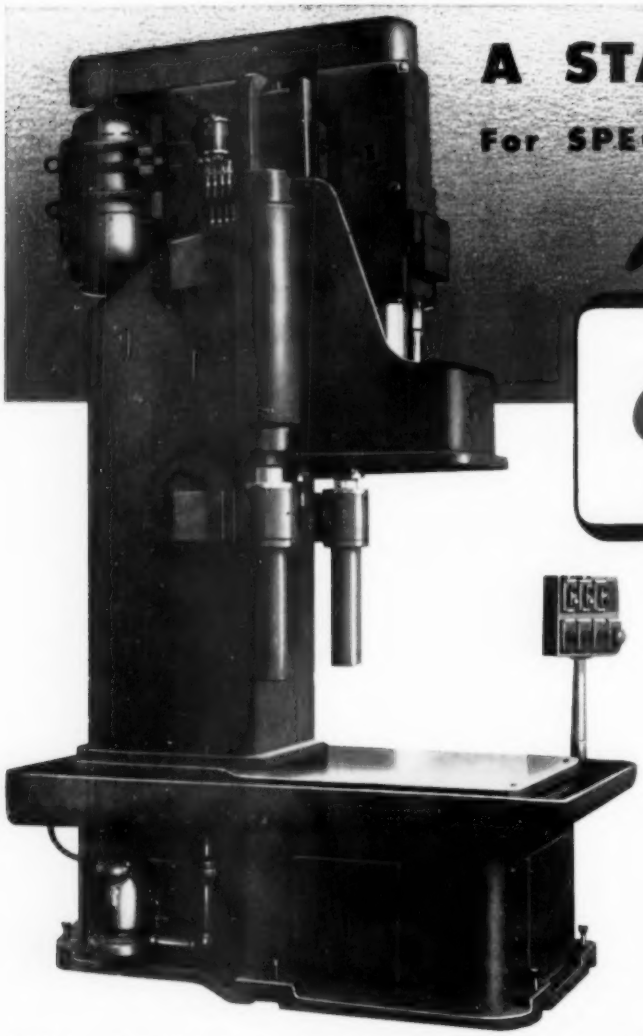
Sheffield MASTER CRAFTSMEN

Sheffield's principal products include Gages, Measuring Instruments, Machine Tools, Threading Tools and Contract Services. Standard Gages shipped within 24 hours.

A STANDARD MACHINE

For SPECIAL PURPOSE ADAPTATIONS *at lower cost*

THE No. 3 Drillmatic



- AUTOMATIC CYCLE . . . HYDRAULIC POWER ENCLOSED IN COMPACT UNIT
- LIFE TIME SADDLE MOUNTING . . . NO SOFT WAYS TO SCRAPE OR IMPAIR MACHINE OPERATION
- LOW MAINTENANCE
- EASILY ADAPTABLE TO NEW OPERATIONS AS PRODUCTION REQUIRES

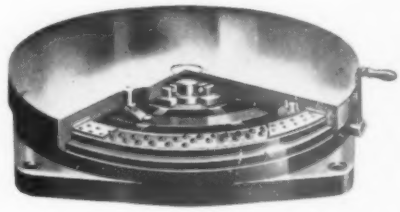
The Robbins No. 3 Drillmatic is really something different in standard drilling machines. The Drillmatic makes it possible to build a special purpose machine at lower initial cost and at the same time, offers the conversion features of a general purpose machine.

Drill heads with any number of spindles may be mounted on the tooling saddle by means of existing locating and hold-down holes. When operations change, the drill head and clamping fixture are quickly removed and replaced.

For Production Indexing—

THE *Robbins* INDEX TABLE

FAST—ACCURATE—DEPENDABLE



The Robbins Index Table is a sturdy production tool combining accuracy with speed of operation and low cost. Designed for operations such as drilling, reaming, tapping, boring, etc., it is readily adapted to a wide variety of applications.

The number and location of the index positions is determined by the specific job. A specially designed stop permits indexing in one direction only . . . an important safety factor. The table is fully supported across the entire diameter against vertical thrust.

A precision radial bearing provides smooth, easy indexing—reduces operator fatigue. The Robbins Index Table is indexed manually—located automatically . . . no slow, hard-to-read dials or scales.

Available in sizes from 18" to 52". Also available in hydraulically indexed models.

For fully illustrated catalogs on both these products, write to

Robbins Engineering Company
318 Midland Avenue • Detroit 3, Michigan

R E *Robbins*
ENGINEERING COMPANY

Producers of ROBBINS MAGNA-SINE • ROBBINS UNIV-ANGLE
ROBBINS SINE PLATE • ROBBINS INDEX TABLES
ROBBINS No. 3 DRILLMATIC • SPECIAL MACHINERY